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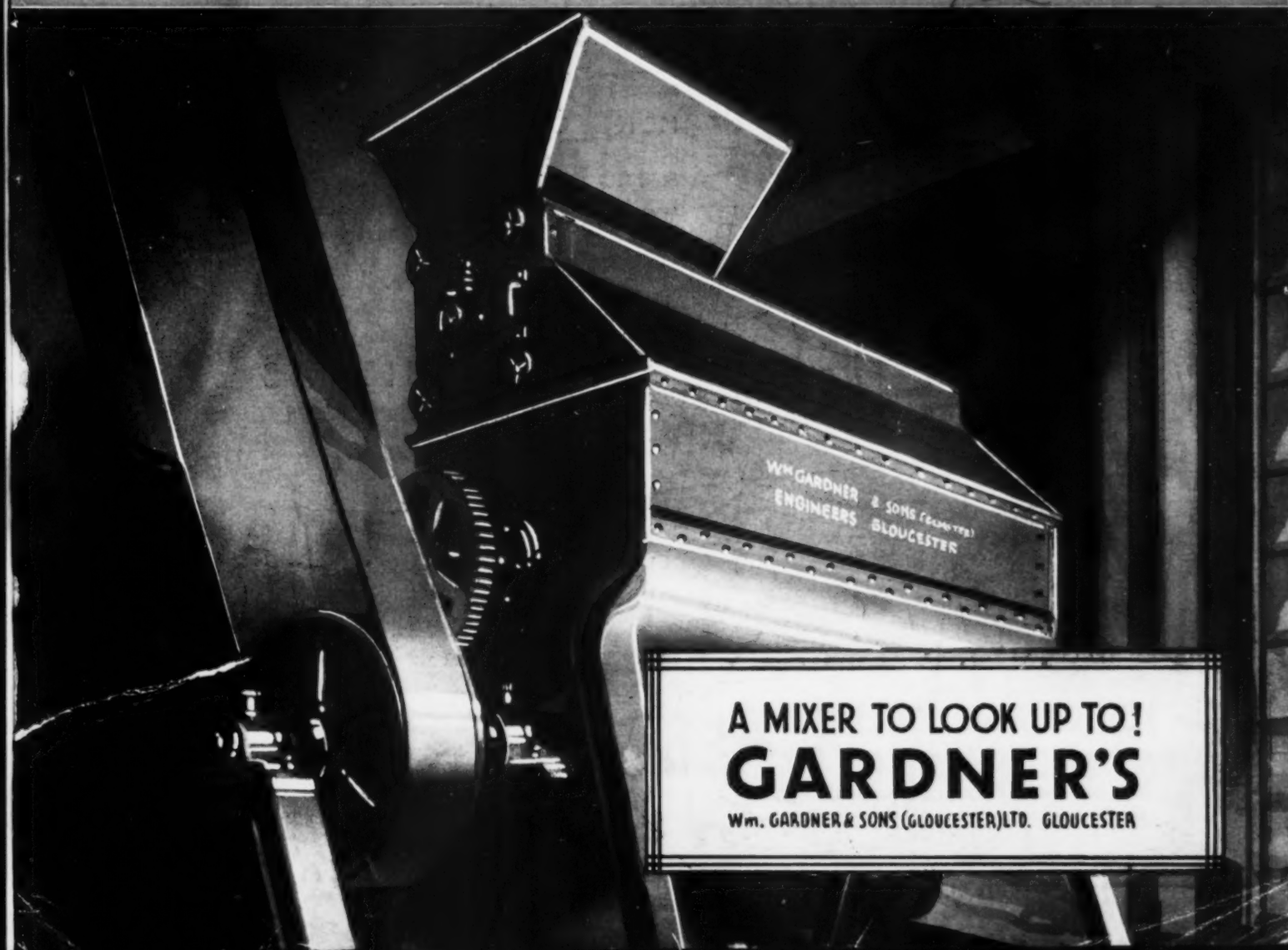
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FOOD MANUFACTURE

Incorporating Canning, Packing and Preserving.

Volume . . . IX
Number . . . 4

APRIL . . 1934

CONTENTS

PAGE

THE EDITOR'S COMMENTS
by Dr. H. B. Cronshaw, B.A., Ph.D., A.I.C. 113

CANNING BEETS AND CARROTS *by Donald Barr* 117

CANNING MACKEREL 119

MUSHROOMS 123

CANNED MEATS
by T. Crosbie-Walsh, F.I.C., F.C.S. . . 124

FRUIT PULPS AND JUICES *by R. S. Potter* . . 126

RASPBERRY PRODUCTION FOR THE FOOD INDUSTRIES *by James D. Vassie, M.A.* . 131

CHOCOLATE FAT BLOOM
by Harold Morgan, M.Sc. 139

pH WITHOUT TEARS
by C. A. Redfarn, B.Sc., Ph.D. . . . 141

INDUSTRIAL NEWS 143

INFORMATION AND ADVICE 145

RECENT PATENTS 150

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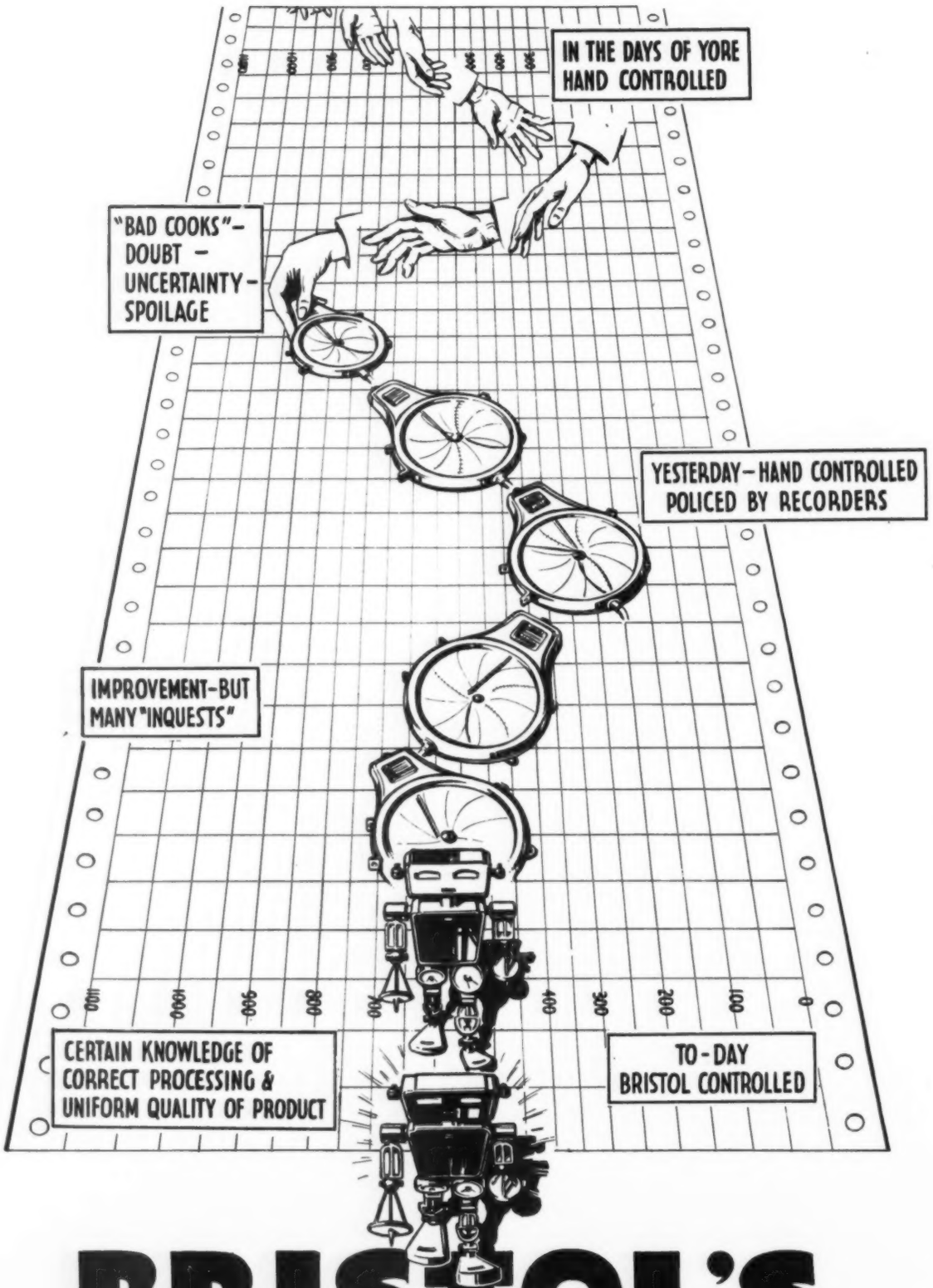
The Editor will be glad to consider contributions from those engaged in the Food Industry. Articles intended for publication should be of a practical nature and accompanied by photographs or drawings when possible.



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FOOD MANUFACTURE

Vol. IX., No. 4 April, 1934

Asparagus for Export

A LITTLE more information can now be given regarding the question of exporting fresh asparagus, a point which was raised by a South African reader and dealt with on page 73 of the February issue and on page 111 of the March issue.

Special care must be given to packing, since moulds develop on the slightest bruises. Two small consignments of asparagus arrived in England from South Africa at the end of last year. The bundles were packed in trays. In one case the bundles were completely wrapped in grease-proof paper: this is wrong; the tops of the bundles must be left exposed. Much of this asparagus suffered from mould spoilage. The second consignment had the tops exposed and arrived in better condition.

From mid-November until Christmas small quantities of good-quality South African grown asparagus should find a satisfactory market.

Asparagus from Argentina

Consignments from Argentina are packed upright in small crates containing one dozen bundles. They are wrapped round with thin grease-proof paper with their tops exposed and well ventilated, and their bottoms resting on a layer of moist moss.

Ice Cream Tallowy Flavour

Mr. O. E. Ross has been trying to trace the origin of the tallowy flavour which occasionally develops in strawberry ice-cream. The trend of flavour development from stale to metallic to tallowy indicates that fat oxidation is the probable cause. The fruit is not responsible, for the same defect was observed in other kinds of ice-cream, but is liable to be masked by the added flavourings. Samples made from condensed skim milk usually contained more copper and developed off-flavours quicker than those made with dry skim milk.

It is believed that copper in the condensed skim milk, in conjunction with oxidation of the fat of the condensed skim milk that may occur during its manufacture and storage, aids in producing off-flavours.

Fruit Juices

It is generally accepted that heat sterilisation of fruit juices is not a method of preservation which holds out much hope of development. The impairment of flavour and vitamin content is very difficult to avoid.

An alternative which has several attractions (apart from the doubtful question of cost) is one in which the air is exhausted from the juice, which is then stored at a suitably low temperature in an atmosphere of carbon dioxide. It is stated that "once a juice is saturated with carbon dioxide, it no longer ferments, but keeps indefinitely." This might well be taken up for systematic investigation with a view to ascertaining the exact conditions under which the statement holds true.

Washing Compounds

A patent has been taken out in U.S.A. for improving the detergent and water-softening qualities of trisodium phosphate by combining it with sodium nitrate to give a double salt in which nitrate replaces part of the water of crystallisation of the phosphate. It is claimed that this gives a product of reduced causticity, lower vapour tension, higher detergent value, and better appearance than trisodium phosphate alone.

This opens up other possibilities for the chemist in enhancing desirable properties of the phosphates by a similar method of producing double salts.

Milky Wastes

The article by Dr. A. G. Norman, of the Rothampsted Experimental Station, which appeared in our last issue was, it so happened, most timely, as since it went to press the Minister of Agriculture's subsidy scheme for the milk industry has been announced. It certainly appears that the milky wastes will be still further augmented! Money is to be taken from the taxpayer's pocket to guarantee milk producers a price over and above the market value of their product, more is to be spent on cleaning up herds—this, surely, a job for the farmers themselves—and still more is to be poured away to launch a publicity campaign which should certainly be the concern of the vendors. What other industry has, in addition to a guaranteed price, financial assistance for looking after its stock and publicity provided gratuitously? How Gilbertian is the situation of John Citizen paying the advertising money to persuade himself to drink more milk for which he will pay more! If some provision had been made for research work to produce absolutely pure milk and to utilise the liquid milk surplus in other ways than making cheap cheese and so on, one might be more sympathetic. It is quite obvious that the complete failure of the beet sugar subsidy has left our politicians unconcerned and oblivious. Possibly they think that it has been a success in so far as it has cost the taxpayer only 40 millions instead of a possible 100! Without adequate provision for sound and sensible research, the milk subsidy is just as likely to provide as big a muddle as has happened in the case of beet sugar. A few farmers will benefit and the rest of us pay. Why won't the Government attempt to make agriculture self-supporting instead of parasitical?

Plain or Polished?

The advisability of the practice of polishing rice has been the subject of considerable investigation since the researches of Takata, which were published in the *J.S.C.I.* (Japan) in 1929, and proved that polished rice contained very little vitamin B. However, Elsdon, the County Analyst for Lancashire, in his Annual Report for 1930, pointed out that the practice of polishing rice by means of talc was becoming less prevalent. Apparently the polishing of rice by talc originated in an attempt to prevent the attacks of weevils (for which purpose, incidentally, it is useless). Although the practice is tending to fall off, a considerable amount of polished rice still finds its way into European markets, and, in view of modern ideas on nutrition and vitamins, it is important that a ready means of differentiation should be available.

The Test

There have been numerous attempts, the earliest being a determination of the cellulose content. In the case of unpolished rice this should not be less than 1·25 per cent. The estimation of the phosphate content can also be used for the purpose. Both these methods are, however, cumbersome and subject to big relative errors, and recent efforts have been directed to the development of simpler tests. In 1930, Spruyt worked out a colorimetric method, using a reagent consisting, among other ingredients, of salicylic acid and phosphotungstic acid.

The latest method recently published by Goudswaard (*Pharm. Tijdschr. v. Ned. Ind.*, vol. 10, p. 112) depends on double staining. The unground rice is treated with a solution consisting of 1 part 10 per cent. potassium ferrocyanide, 1 part strong acetic acid, and 28 parts water. After one minute it is well washed and treated with a solution of ferric chloride. After another minute it is washed again and stained with a tenfold dilution of carbol fuchsine. After washing with dilute hydrochloric acid the rice is allowed to dry in the air. Unpolished rice becomes entirely red, polished rice blue, and a partially polished sample shows intermediate shades.

Spring Sowings

The arable farmers have been very fortunate this year in the extraordinarily dry February, which gave them ideal conditions for early spring cultivation. The land has been in excellent condition for working, and it is a long time since so many acres of barley and oats have been sown in February in such good order. Early sowing usually proves to be the best practice, so that this year's spring corn has certainly had a good send-off. With most of the sowing now finished, rain is the general desire both for cereals and pastures. It is estimated that there has been an increase in the acreage devoted to barley and oats, whereas that for wheat is about the same. Last year's bumper harvest exceeded the standard set up in the Wheat Act and so caused the standard price to be slightly reduced. This has made the farmers more ready to turn to oats and barley. So long as the brewers continue to give preference to home-grown barley and granted

reasonable weather conditions, spring-sown barley should prove a good investment.

Pure Vitamin C

In last month's issue of FOOD MANUFACTURE we referred to recent work on the relation between vitamin C and ascorbic acid—in particular the researches of Svierbely and Szent Görgyi and Bennett and Tarberk. The latest discovery in this direction appears to be that of Tellmans, Hirsch, and Vaubel (*Z. Unters Lebensm.*, vol. 65, p. 145), who have obtained from hips a crystalline reducing compound which is apparently pure vitamin C. They found that half a milligram a day of their product was sufficient to protect a guinea-pig from scurvy. It has an equivalent as an acid of 97·5 to 89 and a reduction equivalent of 175 to 178, as determined both by titration with 2·6 dichlorphenol indophenol and iodometrically.

Good Food Advertising

It is not often that scientific societies dabble in such matters as advertising, but the American Association of Cereal Chemists, in conjunction with the American Medical Association, has recently been paying attention to the various ways of advertising foodstuffs, in order to give the fullest benefits to foods of desired and required nutritional values, and to secure proper and truthful food advertising in the interests of public welfare and health.

In the current issue of *Cereal Chemistry* is to be found a full report of the investigations, with conclusions, of the Committee on Foods delegated to consider the matter. In order to assist the Committee's deliberations, 650 cereal products have been examined. Of these, 450 have fulfilled all the desires of the Committee, 35 have been condemned, and 150 are in abeyance. Before being accepted, practically every product had to have some label or advertising change, and in many cases these were drastically or completely revised.

Public Welfare

It is stated that the purpose of the Committee is to increase the influence and power of good advertising and decrease that of the bad; to increase public acceptance of foods of desired and required nutritional values and decrease public acceptance of foods of undesired and inferior nutritional values. The main idea behind this is that society is dynamic and its standards represent an equilibrium between destructive and constructive forces. The law of the land tends to maintain society *in statu quo*; public welfare activities such as those of the Committee tend to raise society to new and higher levels of human good and health. We congratulate the American Medical Association on its efforts in this social and economic struggle for improving the health of the nation through foods and food advertising.

Bad Advertising

Examples of some of the common inappropriate types of advertising and claims not permitted for accepted cereal products, either because incorrect or not in accord with best trade practices, or not supported by satisfactory experimental evidence, are given in the report. Thus in the case of flour such statements as "Makes more loaves," "Contains all the nourishment of wheat," "Makes cakes and bread that keep fresh longer," the omission of bleaching declaration from the labels, derogatory statements directed at bleached flours, are *inter alia* condemned by the Committee. With regard to wholemeal flours, the Committee is very definite in its opposition to incorrect and vague vitamin and mineral claims, and food faddism advertising is disallowed. In the case of bread, statements of the ingredients must be complete, and they should be listed in the order of decreasing proportions in the formula. This is a basic requirement for all compound foods. Descriptive names of breads must be compatible with their composition, and breads that contain unexpected ingredients must bear label declarations to that effect. Such terms as "health breads" are condemned on the grounds that white bread is as much a health bread as is wholemeal bread.

Ideal Label for Foods

Considerable attention is paid to the container label of foods, and it is insisted that "this should conspicuously present such information as will properly inform the public of the true nature and quantity of the food in the package." It is laid down as an axiom that a properly informative label provides the basis for good, sound advertising, the only kind of advertising the public or the food industry can permit in their own interests. An illustrative diagram of an ideal food label is presented by the Committee for the guidance of food manufacturers, and it is claimed that this represents the type of label the public expects for its own well-

being. According to the Committee's decision the ideal food label presents on the main panel the common name of the food article, accompanied by a statement of any added minor ingredients—*e.g.*, "Rice Flakes—flavoured with sugar, malt, and salt." A fanciful trade name for a food is accompanied by a descriptive statement identifying the ingredients—*i.e.*, "Blanco—contains sugar, dried fruit, eggs, and milk." The net contents and the name of the manufacturer or packer are declared on the main panel faces.

Finally

The efforts of the two American associations in attempting to standardise food advertising and eliminate false and exaggerated claims in the interest of public welfare and health are particularly laudable, especially when one bears in mind the fantastic and frequently entirely inaccurate advertisements so prevalent in America.

Why Canned Meats Spoil

At the annual meeting of the National Canners' Association, Mr. G. W. Hallman discussed the common troubles encountered in canning meats. An examination of a large number of samples of spoiled canned meats and meat products from various parts of U.S.A. showed that the causes of spoilage may be classified as follows:

51 per cent., leakage.
41·5 per cent., understerilisation.
3·5 per cent., hydrogen swells.
2 per cent., no process given.
2 per cent., cause of spoilage not determined.

Thus, in 92½ per cent. of the samples examined, and these are considered to be a fair representation of the various types of spoilage encountered by meat canners throughout the country, the spoilage was due to leakage or understerilisation.

Leakage

Most of the cases of leakage were due to defective soldering or tipping of hole and cap cans and defective top seams in open top cans.

In the first instance the defects were traceable to small pieces of meat or fat which were charred during the soldering operation. This indicates the value of thoroughly cleaning the grooves in which the caps fit. All meat and fat should be removed before attempting to solder on the caps.

Leaks at the tipped vent holes are usually due to the charring of the liquid which is pulled out of the can when it is placed under vacuum.

Frequently, leakage due to defective top seams on open top cans is caused by meat extending over the sides of the cans. When the cans in this condition enter the closing machine, a knocked down flange may result. Closing machine jams occur from this condition, causing interruptions in the canning operations. Parboiling the meat until it is soft and placing any excess of meat near the centre of the can rather than round the side help to overcome the trouble.

Barley

It is stated that the differences in the diastatic activity in barley are largely due to the size of the starch granules. The large and small granules of barley starch have different physical properties. Their specific gravities are represented as 1·526 and 1·114 respectively and their reactions to diastase properties were found to differ considerably.

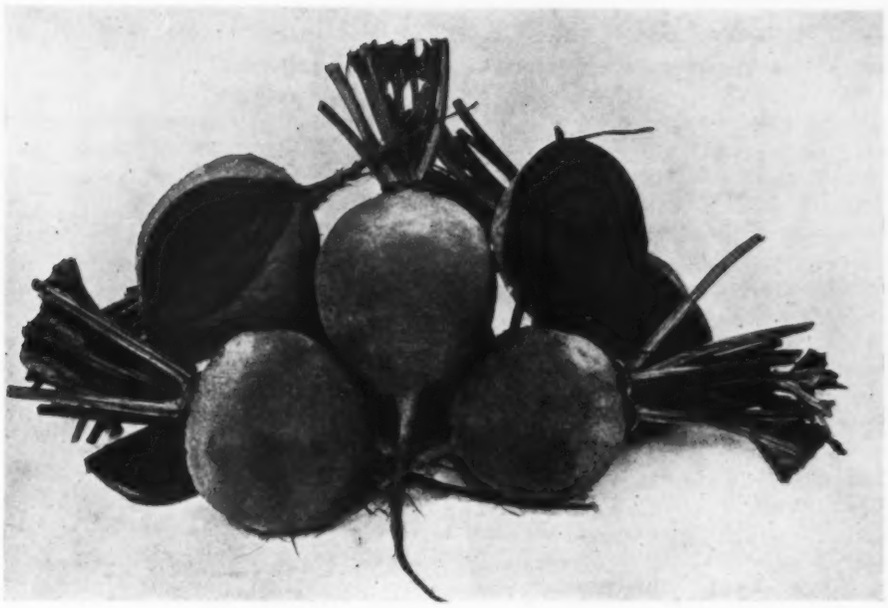
When gelatinised, the small granules converted 89·5 per cent. starch into maltose, leaving 6·6 per cent. residue. The large granules transformed 94·8 per cent. of starch to maltose, leaving only 0·9 per cent. residue. In the ungelatinised condition, however, the small granules yielded maltose close to 86·2 per cent. starch and the larger ones only 69·3 per cent., indicating that in the raw state the small granules are more readily attacked by diastase.

Bread Staling

A Russian scientist, Dr. A. P. Miranov, claimed that, under certain conditions, the addition of a minute amount of agar-agar to dough prevents bread from becoming stale.

In a test, bread loaves after six months' storage were found to be almost indistinguishable from bread fresh from the oven.

Agar-agar was one of the substances added experimentally to bread dough during research conducted in the Food Research Laboratories of the Bureau of Chemistry and Soils (United States Department of Agriculture) by H. L. Bailey. Under the conditions of his experiments, however, he did not obtain such results as were claimed to have been obtained by the Russian worker. It would be interesting to know something about the "certain conditions."



Canning BEETS and CARROTS

Mr. Donald Barr, who is a practical canner with extensive American experience to his credit, gives concise instructions for the cultivation and canning of carrots and beetroots.

CANNED VEGETABLES, conveniently prepared in the home, both nutritious and delicious and, of course, economical, are much sought after by the hostess wanting to serve "something different."

Carrots and beetroots, properly canned, afford a pleasing change in the diet, and can be served in many ways without using stale vegetables from the market, or necessitating hours of kitchen drudgery. A new demand has been created for these two products, and, with that thought in mind, I am briefly outlining the steps in growing and canning carrots and beetroots.

Carrots

The varieties most suitable for canning are the Danvers, Nantes, and Chantenay types. These varieties mature in from fifty to sixty-five days and give excellent yields under normal conditions. The maximum length of the root is about 6 in., with a diameter of 2½ in., although it is advisable to pull carrots when they are in the growing stage, as this will ensure receiving the necessary small carrots for packing whole. The general characteristics of these varieties are their half-long shape, deep orange-red colour, fine texture, extreme tenderness, and excellent flavour, and that smoothness of skin which makes cleaning most easy with a minimum of waste.

Any rich soil if well drained is satisfactory for carrots, although a sandy loam is preferable if well manured, as it assists in ensuring well-shaped carrots. The soil should be well prepared and thoroughly rolled prior to planting, which should not take place before the soil is fairly warm and dry. Drilling about 2½ lb. of seed per acre in rows 24 in. apart will be sufficient for a good crop. Plant the seed only ½ in. deep. The carrots must be well cultivated, and after they are well up the grower can thin out, dependent on the type of raw material wanted by the canner.

For whole carrots a maximum length of 3 in. with a diameter of ¾ in. is permissible, while carrots to be used

for cubes may obtain full maturity, providing they have not split or turned "woody." A much finer finished product from the point of view of texture and flavour is to be obtained from carrots removed from the ground during the growing period. To guarantee that these small carrots will be delivered, it is advisable for the canner to purchase them on a graded basis.

On delivery to the factory, carrots should be washed to eliminate any possibility of bits of gravel being beat into the meat of the carrot during cleaning. Any efficient type of spray washer will do this work satisfactorily.

After washing, the carrots can be peeled in any type of rotary, carborundum, peeling machine. Great care should be taken to ensure that the machine is emptied as soon as the carrots are clean, as excessive waste can develop at this point unless the matter is given careful attention.

After cleaning, the carrots should be emptied on to a moving conveyor table, where they are inspected and resnipped, so that only those carrots free from blemishes will be passed on to the next operation. The resnipping is done by hand. Grading by hand into two sizes can take place at this point.

After resnipping, all carrots are washed again in some type of a rotary or shaker washer to ensure strict cleanliness.

Dicing and Filling

At this point, the large carrots are sent to the dicing machine, where they are cut into $\frac{3}{8}$-in. cubes, with any small chips being shaken out over a screen and thrown into refuse. The small carrots are all packed whole into the can, which is a hand operation. Diced carrots are either filled by hand or by the use of a "universal filler." After filling either whole or diced carrots, a 2 per cent. salt brine is added to the can at as near boiling point as possible. Each can of whole or diced carrots should be filled as full as the maintenance of quality will permit, the net weights of carrots and brine being:

E1's	15 oz.
A2's	20 ,,
A2½'s	30 ,,
A10's	105 ,,

As carrots are cold at the time of filling, it is advisable to exhaust them for one or two minutes in a steam exhaust to ensure a sufficiently high closing temperature for every can.

The processes recommended by practical experience for carrots are:

Size Can.	*Initial Temperature.*	*Cooking Time.*	*Cooking Temperature.*
E1's	160° F.	25 mins.	240° F.
A2's	160° ,,	25 ,,	240° ,,
A2½'s	160° ,,	30 ,,	240° ,,
A10's	160° ,,	45 ,,	240° ,,

Cool the cans thoroughly immediately after cooking to a temperature of 100° F., or less.

Beetroots

The variety of beetroot most suitable for canning is the Detroit Dark Red, which is characterised by its nearly perfect round shape, dark, solid red colour, even texture, and excellent flavour.

Beetroots grow well on practically all types of soil except peatland, although if possible light soils should be used, as they will assist materially in caring for the crop as well as preventing side roots and ill-formed beets which are quite common in heavy soil.

Soil preparations are most important, and it is advised that the ground be well worked and rolled or planked prior to seeding, which can commence as soon as the land is fairly warm, although most canners experience no trouble from this point, as they plant beetroot in June or July for fall harvest, as the colour is much improved at that time.

From 7 to 10 lb. of seed are used per acre, and it is drilled in rows on the average of 18 to 24 in. apart and $\frac{1}{2}$ in. deep. The average period to maturity is from sixty to seventy days, care being taken to pull the beets when in the growing stage and before the development of white rings and woodiness.

On pulling beets, a $\frac{1}{4}$-in. length of the top should be left on to prevent excessive bleeding in case storage of raw material at the factory is prolonged.

As considerable dirt adheres to the beetroot, it is advisable to wash well prior to steaming. Steaming sets the colour and prevents bleeding as well as making possible the easy separation of the skin from the meat of the beetroot itself. Many types of machines are used for this process, but either an ordinary pea blancher or steam retort is most usually used. Blanching in a pea blancher for a period of from 8 to 10 minutes at 212° F. is required.

After blanching, the beetroot is cleaned in a rotary vegetable peeler and then resnipped and graded for size by hand or machinery. The small beets are graded into from two to seven sizes and packed whole, while all larger beets (over 1½ in. diameter) are either sliced into $\frac{3}{8}$-in. slices or diced into $\frac{3}{8}$-in. cubes.

After thoroughly resnipping and grading, the whole beets are packed into the can by hand; the sliced beet has to be filled by hand, although the diced beet can be filled mechanically. After filling, a boiling hot 2 per cent. salt solution is added to the can.

Necessity of Rapid Filling

Great speed in filling and brining is necessary if "blackening" is to be prevented.

A short exhaust to ensure uniform closing temperatures is advisable. The processes recommended for either whole, sliced, or diced beetroot are:

Size Can.	*Initial Temperature.*	*Cooking Time.*	*Cooking Temperature.*
E1's	160° F.	25 mins.	240° F.
A2's	160° ,,	25 ,,	240° ,,
A2½'s	160° ,,	30 ,,	240° ,,
A10's	160° ,,	45 ,,	240° ,,

After cooking, prompt cooling to 90° or less is necessary if the beet is to absorb the maximum amount of colour lost to the brine during processing, and is to present the best possible colour in the finished product.

Canning MACKEREL

Mackerel Canning

CANNED MACKEREL is the most important single product of the California mackerel fishery.

The following description of canning methods applies to the canneries at Los Angeles Harbour. The San Dego, Long Beach, Hueneme, and Monterey canneries employ similar processes. Actual canning methods vary but little at the several canneries, but the methods for preparing the fish for canning are somewhat different.

Unloading from Boats

The fish are unloaded from the boats into either a hoist or a belt conveyor, depending upon the cannery.

The bucket hoist conveyor lifts the mackerel to the top of a tower or winch house on the wharf. The fish spill into large buckets in which they are weighed. There are two buckets, so that when one is full the stream of fish can be diverted to the other. Each one has a capacity of 500 lb. and is suspended on a spring scale. After recording the weight of the bucketful, the winch house man spills the fish into a flume carrying a strong stream of water which washes the fish into a receiving tank in the cannery. From the tank the fish are flushed through flumes to the cutting machines or butchering tables. A flume leads to each table or machine from the bottom of the tank. A man controls the flow of fish from the tank by opening and closing gates on the flume.

At other canneries the belt conveyors carry the fish into the cannery, where they are spilled into dump carts. The carts are pushed on to a platform scale for weighing. The capacity of the carts varies from 500 to 2,500 lb. After weighing, the cart is dumped so that the fish spill on the floor. From the floor they are either shovelled directly on to the cutting tables or are picked up by another belt conveyor to be lifted into a large wooden tank, whence they are distributed to the cutting tables through flumes.

Butchering

The fish should be butchered immediately upon their arrival at the cannery. At present the longest trip made by the mackerel boats bringing fish to the canneries is under five hours, except in isolated instances. Allowing time for making several sets and for awaiting their turn to unload, the fishermen deliver their fish within twelve hours of the time of catch. Unless exposed to the rays of the sun or crushed at the bottom of the hold, the fish should be in good condition for canning when delivered. However, the boats often do not arrive until the evening, in which case the mackerel were formerly held over all night in the cannery because of the difficulty in assembling butchering and packing crews in the evening. When it is necessary to hold them, the cannerymen should ice them thoroughly or, better yet, keep them in chilled brine. All too often this was not done in the early days of the new industry. Many times the fish were left on poorly drained concrete floors all night with little or no ice. In hot weather the loss was very high, and spoiled fish occasionally got into the cans. The cannerymen soon learned their lesson, and fish are no longer held overnight.

All other things being equal, a far better pack can be obtained from freshly delivered mackerel than from fish that have been held overnight. One way the canners can ensure morning deliveries of mackerel is to persuade their fishermen to fish at night, because when the fishing is done during daylight hours delivery cannot be expected before afternoon.

The first steps in preparing the fish for packing are cleaning them and cutting them to the proper size. There are two ways of performing these operations—by machine and by hand. Some canneries use one method, some the other, and some employ both at once when lots of fish are being delivered. A final cleaning by hand always supplements either method.

The machines are similar to those used for cutting sardines except that they are larger because of the greater size of the mackerel. The machines were designed and developed at the canneries, so those in use at no two canneries are exactly the same.

All the machines are alike in that they are located near the "fish tanks" where the fish are stored after being unloaded from the boats. Gate-controlled flumes lead from the tank to deep trays on both sides of the machine. The fish are flushed into the trays, from which they are transferred by hand to the machine.

One type of machine functions as follows: Women operators place the fish, belly up, in transverse grooved metal holders or "cups" on a belt conveyor which carries them into the cutter. The fish are brought into contact with a battery of three revolving disc blades, two of which sever the heads and tails respectively, while the middle one divides the bodies transversely.

This account is taken, by permission of the California State Fisheries Laboratory, from Fish Bulletin No. 40, entitled "The California Mackerel Industry," compiled by Richard S. Croker. We are also indebted to the Laboratory for the illustrations.

Mackerel line in a San Pedro cannery, showing packing table, exhaust box and closing machine. The cut pieces of fish come from tank (1) on belt (2) to packers standing between boxes of empty cans (3). The girls fill cans on table (4) and put them on belt (5), which carries filled cans under salt dispenser (6) to exhaust box (8), which they enter at point 7. The cans may be seen making the turns on the S-shaped track and emerge at 8'. From exhaust box cans go to sealing machine (9) and then to retorts.

The knife which makes the cross-cut through the body is so placed as to cut right at the insertion of the second dorsal fin of an average sized fish. The heads and tails fall into a flume or screw-conveyor and are carried to the reduction plant, where all the waste parts are utilised in the manufacture of fish-meal and fertiliser. As soon as the cross-cuts are made the cup turns automatically so the fish is parallel to the direction of progress. It passes under a revolving blade that slits the belly and a rotary brush that cleans out the greater part of the intestines. At the end of the conveyor where the belt turns back under itself, the pieces of fish drop from the cup on to a belt conveyor, which carries them to a table where women remove the remaining viscera and complete the cuts that the machine sometimes misses. The thoroughly cleaned pieces are thrown on to a belt conveyor which carries them to the packing-room. Two women can feed this type of machine at the rate of 65 to 70 fish per minute, or 1 to 1½ tons an hour, depending on the size of the individual fish. This number of fish keeps six or seven women busy doing the final cleaning.

Another type of machine is similar to the first part of the one just described. A battery of three knives makes the cross-cuts as the fish pass under it in the cups. The heads and tails fall into flumes to be carried away. The butts or tail pieces, which contain no viscera and need no further cleaning, fall into another flume to go on to the packing-room. The larger pieces drop from the cups on to a belt that extends down the middle of a long table. Workers stationed along the table remove the pieces, slit the belly from end to end, and remove all viscera and blood with a knife.

A third type of cutting machine has two conveyors carrying the fish into two batteries of knives. Two women feed each conveyor from a single fish tray. The four women can supply the two conveyors with about 125 fish a minute, so that the machine can cut between three and four tons of fish per hour, depending upon the size of the fish.

There are but two rotary knives in the first battery under which the fish pass. One of these severs the head and the other divides the body into two parts. The heads fall into a flume to be carried away to the reduction plant. The two parts of the body fall on to a belt that passes in front of several women who place the pieces in two conveyors. The butt pieces, still bearing the tail fin, are placed in cups at right angles to the direction of progress. The conveyor carries them under a vertical revolving blade that severs the tails. The women can so place these pieces that very little loss results from severing the tail. The butt pieces drop on to a belt that carries them to the packing-room. The anterior segments, still containing the viscera, are put on a narrow belt, belly down and parallel to the direction of the conveyor. They pass over a revolving blade that slits the bellies and a rotary brush that removes most of the intestines. The conveyor deposits the pieces on a cleaning table, where women remove by hand the intestines that still remain. The cleaners place the thoroughly cleaned pieces on a surveyor that leads to the canning-room.

At all the cutting machines all the operators except the engineers in charge are women. The workers performing the finishing operations of cleaning and cutting are also women. Some canneries employ Japanese women almost exclusively. These are usually wives of the cannery's fishermen. At other canneries mixed crews, comprised of Americans, Italians, Mexicans, and Japanese, are employed.

At the canneries where the butchering is done by hand a specialised type of cutting table is in use. A crew of twelve to sixteen work at each table. The workers are usually either Filipino men or Japanese women.

The workers are stationed at regular intervals along both sides of the long table, which consists of three parts. The first part is in the form of a shallow trough in which the round fish are dumped, either shovelled from the floor or flushed from the storage tanks. The workers at this section behead the fish, split them open, and remove the larger viscera with their knives. The cutting is done on boards nailed over a flume at the sides of the trough where the fish are dumped. The heads and entrails fall through the holes in the boards into the flume, which carries them to the fertiliser plant. The cutters throw the partly cleaned fish to the second section, which consists of a tank of running water. The workmen here use ordinary teaspoons to scrape out the remaining entrails and blood, holding the fish under water. They throw

Mackerel butchering table at the cannery. Note the pile of fish at the left.

the thoroughly cleaned fish on to the third section of the table. Here skilled cutters armed with large butcher knives place the fish in simple mitre-boxes and cut the body into two parts and sever the tail. To do this they place the anterior part of the body against an upright board and make a transverse cut opposite a mark on the table. The anterior or larger piece is about the same length as the height of a 1-lb. tall can. After this cut is made the butcher severs the tail, which drops to the ground to be washed away later. The pieces of fish are tossed into a flume or conveyor which leads to the packing-room or are placed in baskets which are carried to the canning-room. In butchering by hand an allowance can be made for the length of each fish and the cuts can be made so as to result in a minimum of loss. From 1 to 1½ tons of whole mackerel can be cleaned and cut every hour at the average table of fourteen workers.

Both the fish butchers and the cutting machine operators are paid on a time basis.

Washing

After the butchering the fish are washed. Practices at the several canneries vary considerably for this procedure. It was formerly the general custom to soak the cut pieces in a saturated brine solution for 1½ to 2 hours. This is an excellent practice, as the salt not only removes the slime and does away with certain objectionable odours and tastes often present in the mackerel, but also imparts a firmer texture to the flesh. Evidently for reasons of economy and a desire for speed, many of the canneries have abandoned the lengthy brine bath. Brining adds about three cents to the production cost of each case and delays packing for two or three hours.

At one cannery the cut fish are held in a tank of brine only until the tank is partly fllled with fish, after which the pieces are removed to the canning tables as fast as more pieces arrive from the butchering-room. This practice results in an uneven brining. Some fish soak too long and become rather tough, whereas others receive no more than a rinse. At other canneries the cut pieces are merely washed with a stream of either brine or fresh water.

Not all the canneries have abandoned the brine soak, however, and it is hoped that the others will return to it.

Canning

The packing-room is located at some distance from the butchering-room, sometimes upstairs. Most of the packing-rooms are dry and airy in contrast to the dark, wet portions of the cannery where the butchering is done.

The appearance of the packing tables or 'lines" and the methods used for packing are practically the same at all the canneries. The packers are all women or girls of every nationality—American, Mexican, Italian, Slavonian, Japanese, and others.

The girls are placed along a table at regular intervals. Beside or in front of each one is a case of empty cans which the girls fill. As each case is used, a straw boss replaces it and punches the girls' piecework card.

The pieces of fish come from the tank or trays, where they have been washed, on a belt conveyor at the level of and immediately across the table from the girls. The

Mackerel cutting machine. This is the first of the three types described in the text. The women are putting the fish into the "cups" that can be seen on the belt. The cut fish drop from the cups and are carried to the cleaning tables by the conveyor at the right.

girls divert a number of the pieces on to the table with a board until there is a pile in front of each one. Then they fill the cans by packing the centre pieces first and filling the spaces with butt pieces, until each can is visibly full and overflowing. The optimum fill weight of raw, cleaned fish packed in No. 1 tall cans is 17 oz. (Lang and Fellers, 1929). Less than about 16¾ oz. results in a loose pack that is apt to break up under the usual rough handling that freight in transit receives, and more than 17¼ oz. results in an overfilled can. Balance weights should be used, but seldom are.

Cooking

The girls, often assisted by the straw boss, place the filled cans on a belt conveyor that is located above the cut-fish belt. This conveyor carries the cans past an inspector, who cuts off the excess pieces from overfilled cans and adds more to slack-filled cans. In some canneries an automatic salt dispenser drops a small amount of salt into each can as it passes under it. The belt continues, carrying the cans into a long exhaust box containing live steam under no pressure. The passage of the cans through this cooker requires about twenty minutes. In the exhaust box the vacant places become filled with live steam, which condenses, when the can cools, and causes a vacuum.

The cans emerge from the exhaust box, still on the conveyer, to enter the sealing machine. In the canneries, where no dry salt has been added, the cans pass under a stream of hot brine before being sealed. Some canneries apply both dry salt and brine. The liquid fills the empty spaces as well as salting the fish. The lid machine tamps the projecting fish, if any, down into the can, shearing off all that will not fit, and seals the cans with the lids. The machine is the standard double seamer supplied by the manufacturer who furnishes the cannery with cans.

The sealed cans are given a rinse in hot water to wash off the adhering fish and are carried by conveyors to the retort room. Here they fall into large iron baskets which, when full, are wheeled into the retort. In the retort the cans are given a final cooking for approximately 90 to 95 minutes at 240° F. The cooking times and temperatures for retorting and exhausting vary somewhat at the different canneries, but the above figures are the average. The aim in view is to give the whole can right to the centre a thorough cooking.

The foregoing methods apply to the standard "salmon style" pack in the 1-lb. tall cans. This style pack is also put up in ½-lb. cans, which require a little less cooking.

Weight of Fish Required to Fill Case

Including the liquid resulting from cooking, each No. 1 tall can contains at least 16 oz. of cooked mackerel. The standard 48-can case, containing 48 lb. of cooked fish, is the product of from 90 to 120 lb. of raw, round mackerel. Due to excessive butchering losses, very small or very large mackerel will yield but seventeen cases to the ton, whereas a ton of medium or fairly large fish yields as much as twenty-four cases. An average of twenty cases per ton is maintained at most canneries, but this average may be higher or lower, depending upon the efficiency of the cannery itself.

Labelling and Casing

After removal from the retort the cans are allowed to cool in the iron baskets. The next step is labelling. This is done by a labelling machine that automatically wraps and pastes the brightly coloured lithographed labels. The final operation is packing the cans in fibre board or wooden cases, forty-eight cans to the case. The cases are either shipped out immediately to the jobber for sale or storage or are stored at the cannery until sold.

Horse Mackerel

Mixed in with the mackerel delivered at the cannery there are often numbers of horse mackerel. Some of the canneries will not accept the horse mackerel in quantities, but will overlook a small percentage. Sometimes, however, the catch runs as high as 40 to 50 per cent. horse mackerel, and occasionally a boat brings in a load composed entirely of horse mackerel. Some of the canneries accept these loads, sometimes, however, paying less for them.

When there are but a few horse mackerel the cannery workers sort them out to take home for dinner. Those that the workers do not save are run into the fertiliser plant along with the offal and any crushed mackerel. When a load containing a high percentage of horse mackerel is accepted, these are butchered and packed with the mackerel. No distinction is made, except that the tail section of the horse mackerel must be discarded because of the rough scutes along the lateral line. The two species are similar in flavour, and if anything the meat of the horse mackerel is firmer and lighter in colour.

Other Fish in the Catch

Most of the other fish that find their way into the catches of the cannery mackerel boats are either thrown into the offal flumes or saved by the workers, depending on the species. At no time are there enough of these fish to be of any importance, with the occasional exception of the bonito, *Sarda chiliensis*. When a mackerel boat gets a considerable number of bonito in the haul, the crew segregates them out and sells them separately to the fish markets or to the cannery for canning tuna style. If there are but few they are left with the mackerel, usually to meet one of the two fates—fertiliser or cannery worker's dinner. Occasionally, however, a few small bonito—those about the size of mackerel—are butchered and packed with the mackerel as mackerel.

Early Canning Methods

Mackerel have been canned more or less experimentally at different times by many California packers, but no great success ever crowned their efforts until 1927. Many

of the packs were failures themselves, and when they were successful the packers could seldom find a market for the product.

During the World War quantities of mackerel were more or less successfully packed in Southern California. Regarding the canning methods employed in 1917, Cobb (a book, 1919, pp. 50-51) has this to say:

"Upon arrival at the cannery the fish (mackerel) are scaled, eviscerated, the head, ventral and pectoral fins with their supporting bones removed, then cut to fit cans, and the pieces put into a 75° (salometer) brine and allowed to remain here until the blood has been extracted from the flesh, or about 45 minutes, after which they are lightly rinsed in fresh water. The pieces are then put into the cans, care being taken to see that the cans are packed as tightly as possible and slightly above the top to allow for shrinkage in cooling. This is necessary in order that the pack may stand up well under long distance shipment.

"The cans are then inverted and cooked in steam at 2 lb. to 3 lb. pressure for 45 minutes. After removal from the retort the cans are allowed to drain 30 minutes or longer. The cans are then reversed and the pieces of backbone removed. This makes practically a boneless product and adds much to its value at but litttle cost. One-third to one-half fluid ounce of cottonseed or corn oil is then added. The cans are then exhausted for about 10 minutes at 212° F., sealed, and processed 1½ hours at 240° F., or 2 hours at 230° F.

"Some canners pack in bouillon. In this method the head and trimmings should be saved. In making the bouillon 10 gal. of the washed heads and trimmings should be placed in a soup kettle; to which add 12 gal. of cold water, 2 lb. chopped onions, a bunch of parsley, 1 lb. of chopped carrots, ¼ lb. whole juniper berries, ¼ lb. ground white pepper, 2 oz. ground red pepper. Bring to a boil, then simmer gently one or two hours. The liquid should then be strained and 3 per cent. of salt added, when it is ready to be poured in the cans with the fish, in place of oil, after which the cans are handled the same as described above, except that they do not have to be exhausted if the bouillon is put in the can hot.

"Quite small mackerel are obtained in considerable quantities, and these are prepared in the same manner as sardines, and packed either in oil, mustard, or tomato sauce."

MUSHROOMS

Developments in the Cultivation of Mushrooms in England

THAT the artificial cultivation of mushrooms in this country has increased considerably during recent years is evidenced by the accompanying illustration, reproduced by courtesy of Messrs. Broome and Green.

The cultivation of mushrooms in this way is not quite so simple as it looks. As Mr. Eduard Jacobsen, of Berlin, explained in the July, 1933, issue of FOOD MANUFACTURE, the most important factor is the manure, which must, as far as possible, be horse manure (rich in ammonia) mixed with oats, hay, and finely chopped straw. Subsequently the ammonia is well worked up and mixed with soil. Holes are then bored in the beds and the mushroom spawn planted. The type of building shown in the illustration is admirably suited for mushroom culture, in that it is sufficiently dark and may be kept to a temperature of at least 54° F.

According to Jacobsen, the temperature after the spawn has been planted should never fall below 64° F.

Cattle on Darling Downs, Queensland.

Canned Meats

The manufacture and technical control of meat canning operations is continued from last month by T. Crosbie-Walsh, F.I.C., F.C.S.

ALTHOUGH IN large-scale practice the old "cold cure" has been superseded by the "hot cure," the former would definitely be the process to be employed in connection with relatively small-scale operations when the amount of by-product utilisable for extract of beef would not warrant its elaboration.

The manufacture of extract of meat is a highly technical matter and involves the use of vacuum evaporators, filter presses, special finishers, and so on. Considerable storage capacity for dilute soups and those in process of evaporation is essential, and the capital outlay would far exceed that required for a plant devoted only to the manufacture of canned meats.

Thus for a production of anything up to 100 cases per week of the six-pound size the manufacture of extract would not be warranted, in which event the employment of the "cold cure" is decidedly indicated. The quality and characteristics of the finished product obtained by such cure are superior. One of the reasons for this is that bacterial action during pickling produces chemical substances giving a distinctive and piquant flavour to the meat. The partial breakdown of the proteins produces a better texture. The advantage of the cold cure over the hot cure may be likened to that of well-hung meat over freshly killed meat.

The Pickle

The bacterial flora in a cold pickle at the end of the pickling operation is copious and varied. In a sample examined after 14 hours at air temperature were found the following:

B. Subtilis	*M. Albus*
B. Mycoides	*M. Candicans*
B. Vulgatus	*B. Prot. Zopfii*
Sarcina lutea	*Dipl. roseus*
Sarcina aurantiace	*B. coli comunis*
Sarcina alba	

Also, *aspergillius niger* and *penicillium glaucum.*

The management of the pickle during pickling operations is not outstandingly difficult, but constant care is needed. Given a cool cellar or similar location, no refrigeration is necessary. The progress of the operation should be watched carefully, especially towards the end, and in cases of delay or hold-ups of subsequent operations involving the lengthening of the time of pickling. This time must be varied judiciously in summer and winter. The characteristic smell of the pickling meat is an excellent indication of the progress of events. Incipient putrefaction will announce itself by the disappearance of the normal odour, somewhat reminiscent of sour milk.

The very rapid disappearance of nitrite (as ascertained by qualitative tests *in situ*) is a clear danger signal.

The progress of the colouring is noted by cutting in half some of the largest pieces of meat. Given a residue of nitrite at the end of the operation, there is no need to carry on until the very centre of the meat has changed colour, as the final colouring will proceed during the subsequent operations of cooking and sterilisation.

The strength of the pickle will be regulated according to the degree of saltness desired in the finished product. It is controlled in the factory by the hydrometer. If the pickle is used more than once, due allowance must be made for the increasing proportion of salts and solubilised protein proceeding from the previous batches of meat. These will be indicated by the hydrometer as well as by the salt content, but a simple correction may be applied, depending on the number of times the pickle has been used.

Canned meats in general, and corned beef in particular, made from pickle that has been used a number of times has a better and more "matured" taste than that made from fresh pickle. So much so that devices are sometimes used to produce an artificially "used" pickle with which to start operations. There is a limit to which one may use the pickle. There comes a time when certain substances become too concentrated and the pickle has to be dumped. As a more or less empirical guide, the author rejects a pickle when its acid content begins to decrease materially.

Regeneration of Pickle

Used pickle requires to be "regenerated" after each batch of meat has been treated. This consists in its thorough sterilization either by boiling or by heating under pressure. The albumens are precipitated and, together with matter in suspension which they occlude during boiling, are removed by decantation or filtration. The filtrate is a clear liquid containing the salt not taken up by the meat and a small percentage of meat extractives. After cooling, the required strength is made up with fresh salt.

The installation for this operation comprises pumping facilities, cooling tanks, filters, heating tanks, and piping.

The alternative to the regeneration of the pickle is to run it away. This involves the sacrifice of the residual salt. Salt being cheap, this is not a very serious charge upon operations. However, taking into account labour, steam, depreciation, etc., there should remain a balance in favour of the repeated use of the same pickle. And, as has been said, the quality of the meat is much enhanced.

It is important (whichever system is used) to ensure the proper mixing of the salt and water, an operation not so simple in a large tank as might appear. Hand stirring will effect this, but the trouble with hand work of this description in a factory is that it tends to becomes less and less thorough as time goes on, until it disappears altogether, with the result that the unfortunate canner finds one batch of his stuff impossibly salty and another without salt at all! And so occurs once more one of the many "mysterious" problems which beset the canner but which might be explained by the running of an almost concentrated solution of salt to one pickling tank and almost pure water to another.

It may almost appear to be an insult to the intelligence of the existing or prospective canner to suggest that mishaps of this description could occur in his factory, but as soon as a series of operations gets beyond a personally controllable scale, these little setbacks (and a host of others) must be guarded against, especially as one small error may involve the loss of a large quantity of costly material.

Cooking

The simple cooking of the beef after pickling has its pitfalls. The vessels and containers and the provision of steam must be of suitable dimensions for the job. Due attention must be given to adequate stirring during the cooking operation. Many sloppy packs have been traced to a disregard for this detail. Precautions against the undue concentration of the cooking liquors will avoid a variably salty pack.

A balanced squad of labour to handle in a rapid manner the cooked meat is an important item. The sooner the meat is closed into the cans after cooking the better.

Solder

As canned meats are often put into cans with soldered caps, a note about solder may be opportune. There is a tendency to false economy in reducing the tin content in solder. A 50/50 tin and lead solder is more economical in the long run, as it is easier and more economical to work and there is less tendency for pinholes to form.

Zinc chloride as a flux is best avoided, although extensively used. The author recently had brought to his notice a case which was described as a "chemical smell" in a meat pack. This was directly attributable to the introduction of hydrochloric acid and zinc chloride into the can. Neatsfoot oil is an excellent and safe flux.

Characteristics Desired

Once the gamut of operations has been gone through the canner should have a pack with the following characteristics:

After chewing, there must not remain in the mouth any residual material which is tough or fibrous or dry.

The can should be completely filled (with no hollows at the cap), otherwise the retailer doing a "cutting-out" trade will lose several slices and will try another brand.

The block of meat on turning out should be "well faced" with evenly distributed jelly and fat. One often sees packs with the fat accumulated at one end, the jelly at the other, and bare meat in the middle.

The meat should not be honeycombed, but perfectly solid all through. This fault is sometimes encountered and may be due to various causes.

The pack should be firm and sliceable at about 60° F. In summer this temperature will be exceeded and there may ensue complaints about sloppy packs. There is no remedy save one—cooling the can prior to opening.

(*Continued on page* 142.)

Fruit Pulps and Juices

Practical Points in the Use of Preservatives

Mr. R. S. Potter gives valuable, practical instruction on the choice and method of using preservatives for the preservation of fruit pulps and fruit juices.

IN THE issue of FOOD MANUFACTURE for July, 1933, a general description of the commercial methods of preserving fruit pulps with sulphur dioxide was given. It is the intention in this article to show the importance of the correct choice of preservative, as it is only by a careful study of the ultimate product that the best results are to be obtained.

SO_2 or Benzoic Acid?

Under the present Government Regulations, which came into force on January 1, 1927, only two chemical preservatives, apart from such substances as salt, vinegar, sugar, etc., are permitted in foods. These are sulphur dioxide and benzoic acid, and these are intended to include sulphurous acid (which is a solution of sulphur dioxide in water), sulphites, and benzoates. There are only two substances in the benzoic acid class which are commonly met with in commerce; these are benzoic acid itself and sodium benzoate. In the sulphur dioxide class we have the following:

Sulphur dioxide, in gaseous or liquid form,
Sulphurous acid, in 6 to 7 per cent. solution in water,
Sodium or potassium metabisulphite,
Calcium bisulphite (bisulphite of lime),

all of which are well known in industry. The active constituent of each is the sulphur dioxide (SO_2).

Only SO_2, or sulphites, are allowed for preserving fruit pulps, whilst for fruit juices and squashes either SO_2 or benzoic acid may be used, but not both, so that the advantages and limitations of each must be considered before a decision is made.

When a choice between benzoic acid and SO_2 is permitted it will often be found that the actual preservative

value of the amounts allowed of each are approximately the same. Also there is probably little difference between the two in the toxicity to human beings, although no doubt most people would hold preference for SO_2 in this respect, as its end products are more natural to the body. The choice therefore resolves itself into a consideration of the effect of each on the product, and the suitability for any food product ultimately to be prepared from it. These points may be best exemplified by reference to the preservation of fruit pulps intended ultimately for making into jam, and fruit crushes or concentrates for the manufacture of fruit drinks.

I. Fruit Pulps

Not very many years have elapsed since the bulk of fruit pulps intended for jam manufacture was stored in casks, which had been "sterilised" by burning strips of linen which had been dusted with flowers of sulphur, without any further additions. The fruit was filled hot into casks, which were immediately sealed and left undisturbed until required. Mould invariably developed on the surface, and not infrequently the pulp fermented. In fact, the Board of Agriculture and Fisheries in 1915 issued a leaflet on pulping on the above lines, and it was not until after considerable trouble had been experienced that the use of SO_2 was recommended. SO_2 is an ideal preservative for fruit pulps, owing to the fact that it is volatile and can be removed by boiling. This is, of course, in contrast to benzoic acid, which is not materially affected by boiling. Moreover, the colour, which is at first bleached in most fruits, is restored practically unchanged when the SO_2 is removed.

The law permits 2,000 parts per million of SO_2 in strawberry and raspberry pulps, and 1,500 parts in others. Before going further it may be as well to indicate what this means in practice in terms of the various SO_2-containing preservatives mentioned above. Obviously much less liquid SO_2 (*i.e.*, 100 per cent. SO_2) will have to be used than, say, calcium bisulphite, which is usually sold as a solution containing about 6 per cent. of available SO_2. The following table shows the relative strengths of these, and the amount required to give the maximum content of 2,000 pts. per million of SO_2:

Preservative.	*Percentage of SO_2 present.*	*Amount Required per cwt. of Pulp to give 2,000 Pts. per Million of SO_2.*
SO_2 (liquid) ..	100	3½ oz. approx.
6 per cent. calcium bisulphite ..	6	3½ lb., or ½ gal.
6 per cent. sulphurous acid ..	6	3½ lb., or ½ gal.
Potassium metabisulphite ..	56	6¼ oz. approx.
Sodium metabisulphite	66	5¼ oz. approx.

Amounts to Use

With regard to the amount of preservative to use, it should be mentioned that with sound clean fruit it is doubtful if the full permitted amounts are necessary or even desirable. But Nature's laws of preservation appear to follow those for sterilisation by heat. "Times and temperatures" for sterilisation of foods are only relative to the degree of infection; and similar remarks apply to the preservation of foods by chemical preservatives. Fermenting fruit, or bacteriologically unclean fruit, requires a far greater concentration of SO_2 to "hold" it than sound fruit. Quite apart from economy, it is good practice to keep the amount of preservative as low as possible, on account of the difficulty often experienced in removing it during the operation of jam boiling, in order that there shall be less than 40 parts per million of SO_2 remaining in the finished jam. Perhaps the case of blackcurrants deserves special mention in this connection, although the difficulty is by no means confined to this fruit. A residue of SO_2 appears to be fixed in the fruit, and it often becomes necessary either to use a proportion of fresh or canned fruit, or else to add extra water to the pulp in the pan so that a longer boil may be given. This removal of SO_2 in jams to below the permitted limit of 40 parts per million is a real practical difficulty for jam makers, and it is on account of this that special caution is given to cutting down the amount of preservative used for pulps to the lowest safe limit.

Safe Limits

The question may be asked, "What is the safe limit?" This is difficult to answer in definite figures for the

Orchard scene, Okanagan Valley, B.C.

The apple harvest at Burlington, Ontario.

reasons given above. Although the maximum permitted amounts are ample for normal working conditions, yet they may be quite insufficient to preserve fermenting or questionable fruit. A great deal, too, depends upon the method adopted. If the usual method of pulping is followed, the fruit being broken up and only a small proportion of water present, it is not usually safe to go below a final proportion of 1,200 parts per million—*i.e.*, to use about 6 lb. of 6 per cent. sulphurous acid or calcium bisulphite per 3 cwt. cask of pulp. If, however, the pulp is preserved whole by completely covering the fruit with a weak solution of the preservative, an initial concentration of 800 to 1,000 parts per million will suffice, and after absorption of some of the SO_2 by the fruit this may subsequently fall to 500 to 600 parts. When whole fruit is required, as, for example, in the manufacture of glacé or crystallised fruits, this method is useful, but owing to the increased storage space required it is not economical for preserving fruit intended for jam making.

Action of Calcium

Although, as stated earlier on, the active preservative agent in the various chemicals mentioned is SO_2, it should not be a matter of indifference as to which one is used. SO_2 is volatile, and when the pulp is boiled most of it is removed. If sulphurous acid or liquid SO_2 has been used, the residue, if there is one at all, remaining in the fruit is water, but if either of the sulphites is used there is a residue of calcium, sodium, or potassium salts left. Calcium salts, in common with all soluble lime salts, tend to have a hardening effect on the tissues of the fruit, due probably to their entering into organic combination with the substances of the cell tissues. In the case of stone fruits, such as plums, cherries, etc., and other fruits which are not ordinarily made into "whole fruit" jams, this hardening effect is most undesirable. In the case of certain fruits such as strawberries, a hardening influence is often quite beneficial in preserving the berry whole and in a firm condition. But the use of calcium bisulphite should aways be moderate, for, quite apart from the danger of making the berries so hard that they float in the finished jam, thus producing an uneven spread of fruit in the jar, calcium salts appear to have an adverse effect on the setting properties of jams made from pulps which have been stored for lengthy periods. It is probable that this may be due to the combination of the pectin with calcium to form insoluble compounds, but little work appears to have been done on the subject.

Sodium and Potassium

Residual sodium and potassium salts, arising from the use of the sulphites of these metals, have less noticeable influence on jams prepared from such pulps, although there is usually a strong tendency for the fruit to break up during storage. These compounds are often used in place of sulphurous acid or liquid SO_2, on account of the fact that they are solids and can be more easily handled.

Liquid SO_2

The number of manufacturers who use liquid SO_2 in cylinders appears to be small compared with those who use bisulphites or 6 per cent. sulphurous acid, and while the convenience of these latter is undeniable, yet for those who use considerable quantities of preservative in the course of a season the economy of liquid SO_2 should not be overlooked. 6 per cent. solutions of sulphurous acid and bisulphite of lime are apt to lose some of their potency on storage, particularly in warm weather or with careless handling of the casks. Long storage may easily result in 2 per cent. or more of the original 6 per cent. being lost. SO_2, being readily soluble in water, is very

easily made up as required by bubbling the gas from a cylinder through a cask of water. A second cask should be used as a trap for any gas which does not dissolve in the first one. 6 per cent. solutions of SO_2 in water have a specific gravity of about 1·033, and the measurement of this by means of a hydrometer affords an easy way of ascertaining when the desired strength has been attained. This solution may be transformed into a 6 per cent. solution of bisulphite of lime, if desired, by adding the calculated amount of slaked lime.

Jam Making

SO_2 in solution in fruit pulps tends to oxidise into sulphuric acid. The chief factors affecting this change are the amount of air present, the presence of raw (uncooked) fruit, the length of time of storage, and the temperature. This change of SO_2 into sulphuric acid is of great importance, as it means not only loss of SO_2 available for preservation, but also that a very strong, highly dissociated acid is formed in the pulp, which may lead to subsequent trouble in the jam made from it. This problem is probably of sufficient importance to justify a digression for a moment into the "art" of practical jam boiling. It has been found by experience that sugar syrups (and for the present purposes we may consider jams as such), in order that they will not granulate or crystallise during storage, should contain, within limits, definite proportions of cane sugar (sucrose) and of invert sugar (glucose and fructose). Invert sugar is formed from cane sugar by hydrolysis, either by boiling with acids or biochemically by the enzyme invertase. Strong mineral acids such as sulphuric and hydrochloric are very effective in producing this change, even when present in relatively small quantities. Organic fruit acids, on the other hand, such as citric, malic, etc., are able to effect the same change, but owing to the fact that they are only relatively weak acids, the reaction proceeds more slowly. In boiling jam in the factory it is, of course, highly important that the product should be free from the subsequent tendency to granulate, and it is only by very careful regulation of the length of time of the boil, and the acidity of the jam, that the amount of invert sugar is controlled. A safe figure for the proportion of invert sugar is 25 to 30 per cent., above and below which granulation of one form or another may result.

Reverting now to the presence of sulphuric acid in sulphited pulps, it will be seen that quite small amounts of this, formed by oxidation of the SO_2, may increase the amount of invert sugar to dangerous figures, particularly if the boiling is being done by a routine jam boiler without the help of a chemist. The recipe may be followed exactly, but acid pulps will cause vast differences in the keeping quality of the resulting jams if due allowance is not made. For this reason casks of pulp should be filled as full as possible and headed up immediately, so as to leave a minimum of air in them. Also the practice of leaving pulp over from one season to another should be avoided as far as possible, and the temperature of storage should be as low as possible.

Storage Losses

Mention should perhaps be made of the losses in SO_2 which occur during long storage. The liability to loss due to oxidation to sulphuric acid has already been considered, but there are other causes, the more important of which include leaky heads or shives, the fixing of some SO_2 by the organic substances of the fruit, and dispersion of the gas into the headspace due to the latter being excessive. Pulp preserved in casks is, of course, not sterile, even if it has been boiled prior to the addition of SO_2, and if the losses of preservative from one or all of the above causes are abnormal, fermentation may ensue. Over a period of twelve months losses of 1,000 parts per million may not be uncommon, strawberries and raspberries probably being more susceptible than most fruits to deterioration in this way. All these facts point to the necessity of regular examination of stocks to ascertain the extent of the loss. If found to be very deficient, the SO_2 content may be made up by further additions, and the pulp may thus be saved from complete loss from fermentation.

Potential fruit pulp and juice. An Ontarian fruit farm.

II. Fruit Juices and Squashes

For fruit juices and squashes (excluding grape juice) the Regulations permit the use of either benzoic acid or SO_2.

Benzoic Acid

There are certain objections to the former; it tends to cause discoloration in some fruits, and also crystals of benzoic acid may separate out during storage. SO_2, in one of the forms mentioned above, is therefore most frequently used. It has also been found that the palatability of fruit juices, notably lemon juice, preserved with SO_2, is superior to juice preserved with benzoic acid. Benzoic acid is, however, used extensively in the U.S.A., in those instances where preservation by pasteurisation is not adopted. One-tenth of 1 per cent. is generally used, and is ample for most purposes. This amount corresponds to about 7 oz. of sodium benzoate per 40 gal. of juice. It has been found that bottled carbonated beverages require less preservative than uncarbonated ones, due to the effect of the carbon dioxide in solution. For carbonated beverages 500 parts per million have been found to be adequate. In this country, however, the maximum amount permitted is 600 parts per million.

The amount of SO_2 permitted in fruit juices (apart from grape juice) is 350 parts per million, but it is now permissible to use twice this amount for preserving orange and grapefruit juices which are intended for squash manufacture. The amounts of the various SO_2-containing preservatives required to give the maximum permitted concentration are shown in the following table:

Preservative	*Percentage of SO_2 Present.*	*Amount required per 100 gal. Juice to give 350 parts per Million.*
SO_2 (liquid) ..	100	5½ oz.
6 per cent. calcium bisulphite	6	4½ pints.
6 per cent. sulphurous acid	6	4½ pints.
Potassium metabisulphite ..	56	10 oz.
Sodium metabisulphite ..	66	8 oz.

In the case of orange and grapefruit juices, twice the above amounts would be allowed, but the concentration of SO_2 must be reduced by adding a proportion of fresh fruit juice or sugar syrup, so that the final squash will contain only the 350 parts per million.

Commercially the easiest procedure, and indeed often the only alternative, is to add sugar syrup to the fruit juice. Most fruit drinks in this country are prepared from the squashes by dilution with about 6 volumes of water, but in the U.S.A. the usual dilution is only about 3 volumes. The degree of dilution in the final beverage is obviously important, since the regulations permit only 70 parts per million in sweetened mineral waters. Assuming that 1½ fl. oz. of the squash (containing 350 parts per million of SO_2) are used to each ½ pint of the finished beverage, the following commercial recipes would give the manufacturer a margin:

100 gal. juice (containing 350 parts per million SO_2),
100 gal. sugar syrup (about 45 Brix.)

10 oz. pot. metabisulphite
or 5½ oz. liquid SO_2
or 8 oz. sod. metabisulphite
or 4½ pints 6 per cent. sulphurous acid

} All giving approx. 5½ oz. SO_2.

The 100 gal. of juice would contain 5·6 oz. of absolute SO_2, which, together with the 5½ oz. included in addition, would give a total of 11·1 oz. per 200 gal. of squash. This represents 350 parts per million. The finished beverage, diluted 1½ oz. to the pint, would therefore contain 52½ parts per million.

10 gal. fruit juice concentrate (containing 350 parts per million of SO_2).
50 gal. sugar syrup (about 45 Brix.).

5 oz. pot. metabisulphite.
or 2¾ oz. liquid SO_2.
or 4 oz. sod. metabisulphite.
or 2¼ pints 6 per cent. sulphurous acid.

} All giving approx. 2¾ oz. SO_2.

The 10 gal. of fruit juice concentrate would contain 0·56 oz. of absolute SO_2, making a total of 3·31 oz. in the 60 gal. of squash. This represents $\frac{3{\cdot}31 \times 1{,}000{,}000}{60 \times 10 \times 16}$ or 345 parts per million. The finished beverage would then contain $\frac{345 \times 1\frac{1}{2}}{10}$, or 52 parts per million.

Action on Vitamins

An article on the preservation of fruit juices would not be complete without mention of the effect of SO_2 on the vitamin content of juices. A large amount of work has been done on the subject in recent years, particularly in respect of the citrus fruit juices. Davey[1] showed that the antiscorbutic vitamin of lemon juice was preserved at temperatures near freezing point by 0·06 per cent. (or 600 parts per million) of potassium metabisulphite. But at higher temperatures a destruction of the vitamin occurred. It was found later[2] that five-sixths of the antiscorbutic potency of lemon juice was lost after 4½ years' storage, when 0·06 per cent. of potassium metabisulphite was present. Williams and Corran[3] conclude that potassium metabisulphite is the best (of several, including sodium benzoate) preservative for lemon juice against fermentation, but that it has a deleterious effect on the vitamin C content at ordinary room temperatures.

[*Photographs by courtesy of the High Commissioner for Canada.*]

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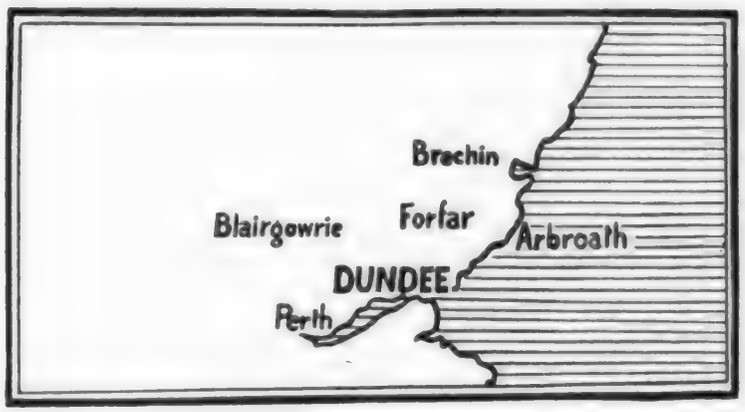
[1] Davey, *Biochem. J.*, **15**, 83, 1921.
[2] Delf, *ibid.*, **19**, 141, 1925.
[3] Williams and Corran, *Biochem. J.*, **24**, 37, 1930.

RASPBERRY PRODUCTION

for the Food Industries



An economic study of the raspberry industry of Angus and Perthshire, in Scotland, by James D. Vassie, M.A. (With indebtedness to the late Dr. J. S. King and the Department of Agriculture, Scotland.) This article should be carefully read by all fruit canners, as it presents data collected at considerable trouble and expense.

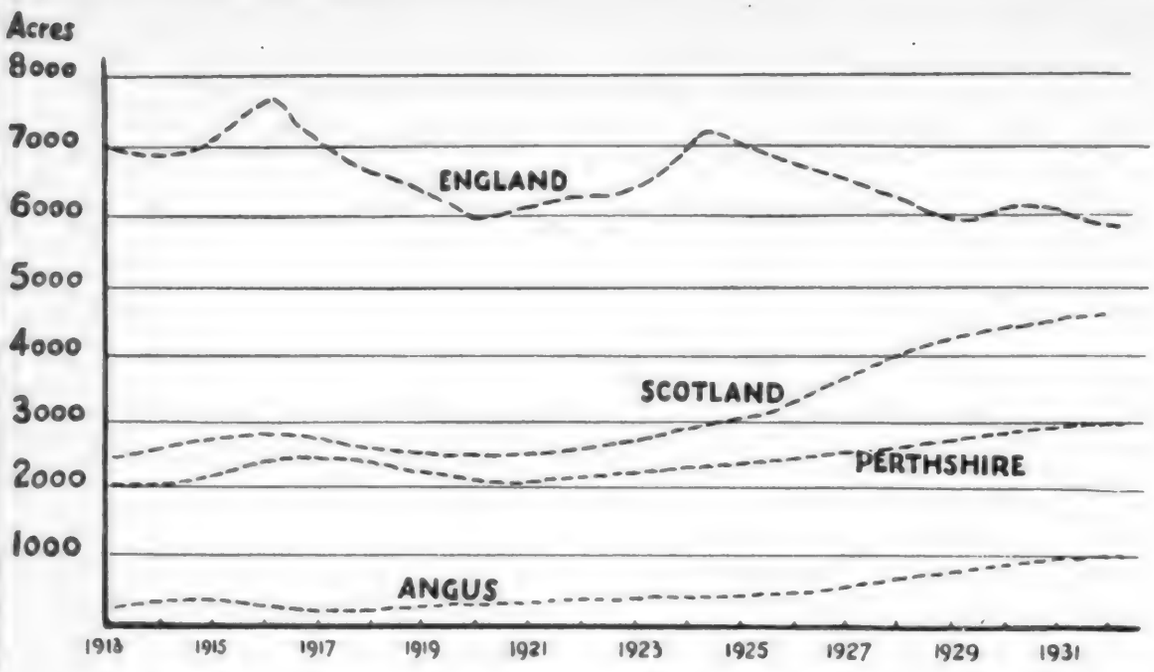
THE RASPBERRY industry of Angus and Perthshire is a subject worthy of study for several reasons. Not only is that area the largest raspberry producing area in Great Britain, but perhaps in no other area in the country have the problems confronting the fruit growers been the subject of more enlightened discussion. An analysis of the industry therefore will serve not merely to extend knowledge, but will enable the peculiar problems confronting the fruit growers to be more closely appreciated.

Development of the Industry*

The raspberry industry of Angus and Perthshire is a development of comparatively recent years. At the close of the last century the area around Blairgowrie in Eastern Perthshire was noted for its strawberries. But it became increasingly difficult for the growers to meet the competition of more favoured localities further south. This was the fundamental factor which favoured the transition to raspberry growing. The presence of the wild rasp in the vicinity indicated the suitability of the area for the new culture. The first endeavours at Blairgowrie in the eighties and nineties of the last century were on a very small scale. One Blairgowrie solicitor created a furore by laying down eleven acres in raspberries. The demand for raspberries from jam manufacturers steadily increased, and, once the proposition was proved profitable, all classes of people came to Blairgowrie to take up the cultivation of raspberries. These people were in the main advanced in years—men who had accumulated a certain amount of savings and desired to take up some congenial occupation for the rest of their lives.

In the subsequent history of the industry two factors are clearly discernible. On the one hand, there were dealings in real estate; large estates in various parts of Angus and Perthshire—*e.g.*, at Essendy, Alyth, and Coupar Angus near Blairgowrie, at Auchterarder near Perth, and at Kirriemuir in Angus—were bought up by limited companies or private gentlemen and split up into holdings for raspberry cultivation. Considerable super-

* *Vide* J. M. Hodge, *Raspberry Growing in Scotland*, for an account of the industry in its early years.



The Acreage of Rasps, 1913-1933.

vision was exercised over the manner in which these holdings were utilised. On the other hand, the desire of Blairgowrie growers to extend their acreage, or of their sons to acquire holdings of their own, led to an efflux from Blairgowrie to other centres, such as Forfar and Dundee in Angus, and Longforgan in Perthshire. The presence of the wild rasp in the vicinity gave an indication of the suitability of a particular locality for the cultivation of the plant.

It is of interest to analyse the development of the industry during the last three decades. The following chart traces the development of raspberry growing since 1913.

It will be seen that the development in Scotland stands in marked contrast to the development in England. The greater fluctuation of acreage in England in contrast to Scotland is notable. Again, while in 1913 the Scottish acreage was but one-third that of England, now the proportion is over two-thirds. The chart shows clearly the importance of Angus and Perthshire in the Scottish raspberry industry. In 1913 the area accounted for 82 per cent. of the Scottish total; in 1932 it accounted for 85 per cent. of the total. The most striking conclusion to be drawn from the chart, however, is the rapid development of raspberry growing in Angus since the war, and especially since 1925. The acreage in Angus increased from 170½ acres in 1918 to 549¾ in 1925 and to 1,194 acres in 1932. This rapid development in Angus in recent years is due almost entirely to the entry into the industry of jam manufacturers with their headquarters at Montrose, and to the development of large-scale growing at Dundee. During 1930-31 there was a check to the increase in acreage in the two counties, but after 1931 there was a renewed expansion following upon the establishment of canning factories at Dundee, Montrose, and Blairgowrie.

Location of the Holdings

To-day the raspberry holdings are to be found in two long bands stretching south-west to north-east across the

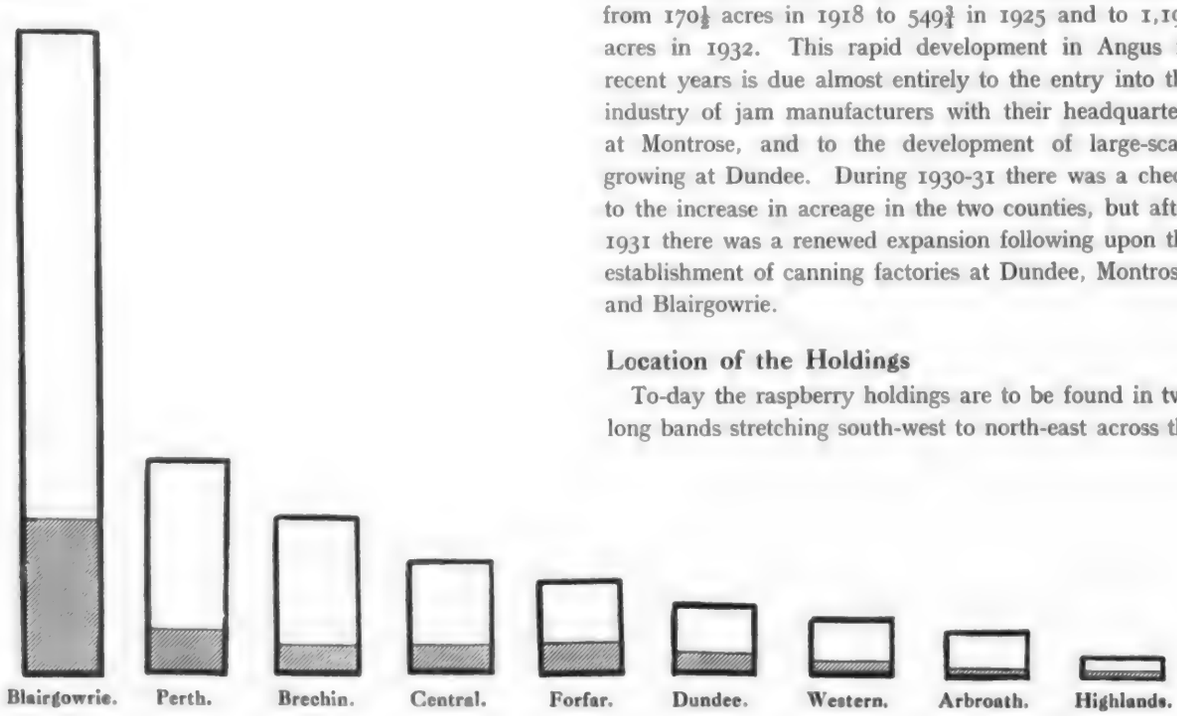


TABLE I.—THE RASPBERRY HOLDINGS IN ANGUS AND PERTHSHIRE IN 1931.

Size of holding (acres)	1–5	5–15	15–30	30–50	50–75	75–100	100–150	150–300	Over 300	Total
No. of rasp holdings	112	156	53	36	32	11	23	27	10	460
No. of holdings owned	38	44	24	13	15	5	13	19	4	175
Acreage occupied	387	1,383	1,131½	1,570	2,018¾	1,962¼	3,083¾	5,345¾	36,302½	20,512½
Acreage under rasp	168¾	577¼	463½	431½	579	164	315	1,006	265	3,969

two counties. The main one runs through the valley of Strathmore and includes important centres of production around Blairgowrie, Coupar Angus, Lethendy, and Alyth in Eastern Perthshire, also around Forfar, Kirriemuir and Brechin in Angus. The lesser one is to be found in a band about ten miles to the south, and, while not so continuous, is especially prominent at Auchterarder and Longforgan in Perthshire and around Dundee in Angus. The main limiting factors appear to be not so much temperature and rainfall, but rather exposure to wind and frost, and especially soil conditions. The heavy texture of the soils of the Carse of Gowrie explains the relative absence of raspberry growing in that area. The chart on p. 132 (Proportion of Acreage under Rasps in the Various Districts, 1931) reveals the relative importance of the various districts in the industry.

The total area of the diagrams represents the total area occupied by the raspberry holdings and the shaded portions represent the area devoted to raspberries. The predominant place of the Blairgowrie district in the industry is evident.

Size of the Holdings

So far nothing has been said of the size of the holdings, nor of the type of grower engaged in the industry. The above table endeavours to analyse the industry with a view to discovering the relative importance of the various classes of holdings within the industry, and whether the holdings are owned or occupied.

The position is analysed for 1931, but the structure of the industry has not materially changed since that date. In that year it will be seen that there were 460 raspberry holdings in the two counties. By far the most important numerically were the 112 small holdings and the 156 holdings from 5 to 15 acres. Together these accounted for 745 acres of raspberries. The 27 holdings from 150 to 300 acres accounted for the largest acreage of raspberries—namely, 1,006 acres—while the 32 holdings from 50 to 70 acres were the next most important with 579 acres of raspberries. The large proportion of the holdings owned, especially among the smaller holdings, is noteworthy. In Perthshire there were 368 holdings, of which 44 were owned. In Angus, however, 584¼ acres out of a total of 1,085 acres of raspberries were grown on holdings over 100 acres. In Perthshire the largest holding account for 875¼ acres out of a total of 2,883 acres. The largest holdings are therefore more important relatively in the industry in Angus than in Perthshire.

With regard to the industry in Perthshire, there were 225 raspberry holdings in the Blairgowrie district, 93 in Perth district, and 37 in the central district. In Angus there were 40 holdings in the Forfar district, 22 holdings in the Dundee district, 19 in the Brechin district, and 11 in the Arbroath district. So far as the small holdings are concerned, 55 were in the Blairgowrie district, 24 in the Perth district, 11 in the Central district, 8 in the Forfar district, 4 in the Brechin district, and 6 in the Dundee district or division.

Type of Farming on Raspberry Holdings

The type of farming carried on in the raspberry holdings is that common to Angus and Perthshire. The usual farm crops common to the area—potatoes, oats, and turnips—are to be found together with raspberries. Pigs, fowls, and cattle are also kept. In the larger holdings oats, potatoes, and turnips are important sources of income, and there is reason to believe that there is greater adaptability on the part of the larger growers. Again, the larger holdings are less dependent upon outside sources for their supplies of natural manure, due to the greater number of cattle kept. Among the small holdings oats, potatoes, and turnips cannot rival with raspberries as a source of income, though the large number of fowls kept is notable. Analysis revealed that 16 of the 23 holdings from 100 to 150 acres, 15 of the 27 holdings from 150 to 300 acres, and 8 of the 10 holdings above 300 acres had less than 10 per cent. of their arable land under rasps. On the other hand, 29 of the small holdings 1 to 5 acres and 20 of the holdings from 5 to 15 acres had all their land under raspberries, while 17 of the holdings

Fruit gathering in Scotland.

15 to 30 acres had over 75 per cent. of their land under raspberries. The difference is important, because it indicates that the smaller holders are dependent to a greater degree upon raspberries for their livelihood. The small holder especially, due to his specialisation and his relative inability to keep fruit off the market, is most severely hit by depression. The large grower is able to distribute his risks, and, further, he can increase his acreage under rasps if prices rise, and decrease it, though perhaps less readily, if prices fall. If there is a marked correlation between prices and available output, then a considerable part of the instability in the industry must be attributed to the greater degree of mobility possessed by the large growers.

Cultivation of the Crop

So far as the method of cultivation is concerned, there is little variation throughout Angus and Perthshire. The plant is one comparatively easy to grow, and this explains the entrance into the industry of all classes of men. Before planting the land must be thoroughly cleaned with a cleaning crop such as potatoes. The plants are planted in rows 5 ft. apart with 2 ft. 6 in. between the plants. About 6,000 plants to the acre are required. Planting takes place either in the autumn or in the spring. During the first year the plant is pruned to a height of 9 in.; this makes it hardier and promotes stronger growth. During this year potatoes are usually planted between the rows. In the second year posts 5 to 6 ft. in height are inserted at intervals of 50 to 75 yards along the rows and are connected with wires—one or two at the top and one halfway up the post. The shoots of the plant are laced with twine to the wires. "Tying-up," as this operation is called, is a skilled operation, and the workers are paid by the piece—at a rate of 4d. per 100 yards of single wire, in recent years. The land is ploughed in winter and in early spring. Manuring takes place in spring. It is contended that the plant needs about 10 tons of natural manure and 7 cwt. of artificial manure annually per acre, but few growers in the area give these amounts.

The plant is usually allowed to bear fruit in the second year, and is usually at its best from the third to the sixth year. As a commercial proposition, it has a life of about ten years, though this depends upon the variety and treatment accorded to it. Each year the old shoots are cut out and the young shoots are thinned to four or five in number. The crop is ready for picking about the third week in July, and picking lasts for six or eight weeks until the early part of September. Some parts are earlier than others; Blairgowrie, for example, is about one week earlier than Dundee. The pickers are drawn from all classes—tramps, unemployed, students, holiday-makers, and women and girls, though preference varies with the locality and the individual grower.

During the first week the crop is small. During August it is at its greatest, and during the last week of picking in September it is again small. The picking organisation therefore has to be adjusted to meet these varying conditions. Each year, before picking, the growers hold a meeting to decide the rate of wages to be paid. In the years immediately preceding 1931 it was customary for the growers to pay ½d. per lb. for picking for jam and ¾d. per lb. for picking for dessert purposes. It was felt, however, that the margin of ¼d. was too large, and in 1931 it was agreed to introduce eighths of a penny.

In picking, each picker does one side of a row. If picking for jam, he has a small basket or pail attached to his waist, which he fills and then empties into a larger pail lying somewhere in the row. The latter, when full, is taken to the weigher to be weighed and emptied into barrels. During the first two or three years before the plantation is in full bearing, comparatively few pails are required. When it is in full bearing, about four pickers to the acre are required, and each picker requires a large and a small pail. The large pail costs 1s. and the small pail 8d., while the barrels cost 10s. each. About 20 barrels to the acre are required.

The pickers usually work from 7 a.m. to noon, have a short break for lunch, and then work until 5 p.m., with occasional overtime. Housing arrangements have to be provided. An excellent example of their bothies is to be seen at Essendy, four miles north of Blairgowrie. So far as the earnings of the pickers are concerned, it is not unusual for an experienced worker to earn 10s. a day—*i.e.*, to pick about 2 cwt. of fruit—and for a first-timer to earn from 5s. to 7s. 6d. per day. They have to provide their own food. It is thus seen that the operations involved in growing the crop are comparatively straightforward.

Fruit for jam is marketed in barrels; for dessert purposes, in tins, or in 4- or 2-lb. baskets; and for the cannery in 4-lb. baskets, though the practice of filling direct into the cans has been attempted. In recent years the development of pulping—preserving fruit at the height of the season in a solution of sulphur dioxide for jam purposes—has introduced a marked change, but at present it is mainly confined to the larger growers and dealers.

Marketing of the Crop

In marketing the fruit the main functionaries engaged are local dealers, or commission agents, wholesale brokers, agents of manufacturers, and one association of producers at Kirriemuir. Many of the local dealers, who altogether number about twenty, trade in other products as well, while some of them are actually raspberry growers. Generally speaking, only the large growers are in direct contact with the jam manufacturers. Custom plays a large part in the marketing of the fruit. It is not unusual for a grower to market his product year after year through the same dealer or agent, who, in turn, sells always to the same manufacturers. By the time of the harvest practically one-half of the fruit has been sold forward. A common feature in marketing arrangements is the advance of "sub"—a loan of £5 per ton—by dealers to the less fortunate of their clients in order to provide them with working capital until the harvest period.

Prices fluctuate tremendously, not only from year to year, but from season to season, and, indeed, from week to week. There is what is called an opening, a mid-season, and an end-of-the-season price. A common feature is for week-end gluts of fruit to cause a depression in prices.

Markets for the Fruit

The table reproduced below gives an insight into the output of the area and consequently into the size of marketing organisation required.

If an opinion is to be passed on the adequacy of marketing methods it is necessary not merely to know the output of the area, but also the destination of the fruit. The railway company allowed the destination of practically two-thirds of the fruit for 1931 to be analysed. As a result of that enquiry it was ascertained that in Scotland fruit from Blairgowrie, the collecting centre for the most important district, finds its chief markets at Shieldhall, Glasgow (206 tons), and Baillieston (71 tons). In England the chief markets for Blairgowrie fruit are Middleton Junction (176 tons), Manchester (170 tons), London (147 tons), Preston Road (107 tons), Gateshead (72 tons), and Leeds (69 tons); while in Ireland Belfast took 76 tons and Dublin 29 tons. The chief markets for fruit from Coupar Angus in England are London (46 tons) and Middleton Junction (31 tons), while in Ireland Dublin took 18 tons. It was also ascertained that 90 tons of raspberries went from Forfar Station to Liverpool and Bristol.

So far as jam fruit is concerned, it will be seen that the major markets for fruit from Angus and Perthshire are to be found in areas relatively close to the major raspberry growing areas in England. In catering for the English markets, has the Scottish area any definite advantage? It seems generally accepted that, with regard to yields per acre, the Scottish area is definitely superior. The average yield for England is given as about 20 cwt. per acre, while that of Angus and Perthshire is reckoned to be about 30 cwt. A main advantage possessed by Angus and Perthshire, however, seems to be the superior quality of its fruit. It is difficult to ascribe a reason for this superiority, but it may be largely due to differences in soil, and especially in climatic conditions. In the southern producing areas of Great Britain the temperatures are uniformly higher, but in Angus and Perthshire the summer days are longer and the hours of bright sunshine greater. Further, the

TABLE II.—OUTPUT AND PRICE OF RASPS FOR JAM IN ANGUS AND PERTHSHIRE, 1909-1931.*

(*Prices not corrected by index numbers.*)

Year	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Output of Angus and Perthshire (tons)†	5,285	4,174	3,651	3,404	3,822	4,070	2,442	3,697	3,026	2,058	2,487
Price of jam fruit (per ton)	£13 3 4	£29	£29	£32	£29 6 8	£23	£21	£37 5	£45 5	£77	£100
Year	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931
Output of Angus and Perthshire (tons)	2,402	3,140	2,625	3,167	4,464	3,497	3,742	4,223	5,244	6,752	4,727
Price of jam fruit (per ton)	£75	£50	£50	£53 6 8	£55	£44	£40 10	£36 10	£33 6 8	£15	£15

* Compiled from returns of railway companies. From 1925 estimates for road traffic have been added.
† *I.e.*, Fruit marketed excluding fruit left on the fields.

TABLE III.—COST OF PRODUCTION PER ACRE OF RASPBERRIES IN ANGUS AND PERTHSHIRE, 1923-1932.

Year	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932
Rent (per acre) ...	5	5	5	5	5	5	5	5	5	5
Horse work	3	3	3	3	3	3	3	3	3	3
Plants	9	—	—	—	—	—	—	—	—	—
Planting	2	—	—	—	—	—	—	—	—	—
Manure and Lime* ...	5	5	5	5	5	5	5	5	5	5
Manuring*	1 10	1 10	1 10	1 10	1 10	1 10	1 10	1 10	1 10	1 10
Cleaning	3	3	3	3	3	3	3	3	3	3
Wire	—	3 10	—	—	—	—	—	—	—	—
Tying up	—	1	1	1	1	1	1	1	1	1
Posts	—	4 3 4	—	—	—	—	—	—	—	—
Posting and wiring ...	—	1 10	—	—	—	—	—	—	—	—
Depreciation (average)	3	3	3	3	3	3	3	3	3	3
Total ...	£31 10	30 13 4	21 10	21 10	21 10	21 10	21 10	21 10	21 10	21 10

* *I.e.*, £10 for Manure and Lime and £3 for Manuring every second year.

difference in the type of rainfall may be of significance. In the Scottish area the increase in rainfall during the vital months of June, July, and August is prominent.

Cost of Production

So far nothing has been said with regard to cost of production. The table reproduced above gives an insight into the various items in the costs of production for recent years, as derived from a sample enquiry into several large holdings in the area.

Over a period of ten years—the average life of the plant—the total cost is £234 3s. 4d., or approximately £23 10s. per acre per annum. If to that cost, picking costs be included—the average yield being taken as 30 cwt.—the following costs have to be added:

	£	s.	d.
Picking costs (per acre) at ⅝d. per lb.	8	15	0
Overseers' charges	2	0	0
*Barrels, etc.	1	10	0
Total ..	£12	5	0

The total cost per acre is therefore £35 15s., or approximately £23 16s. per ton.

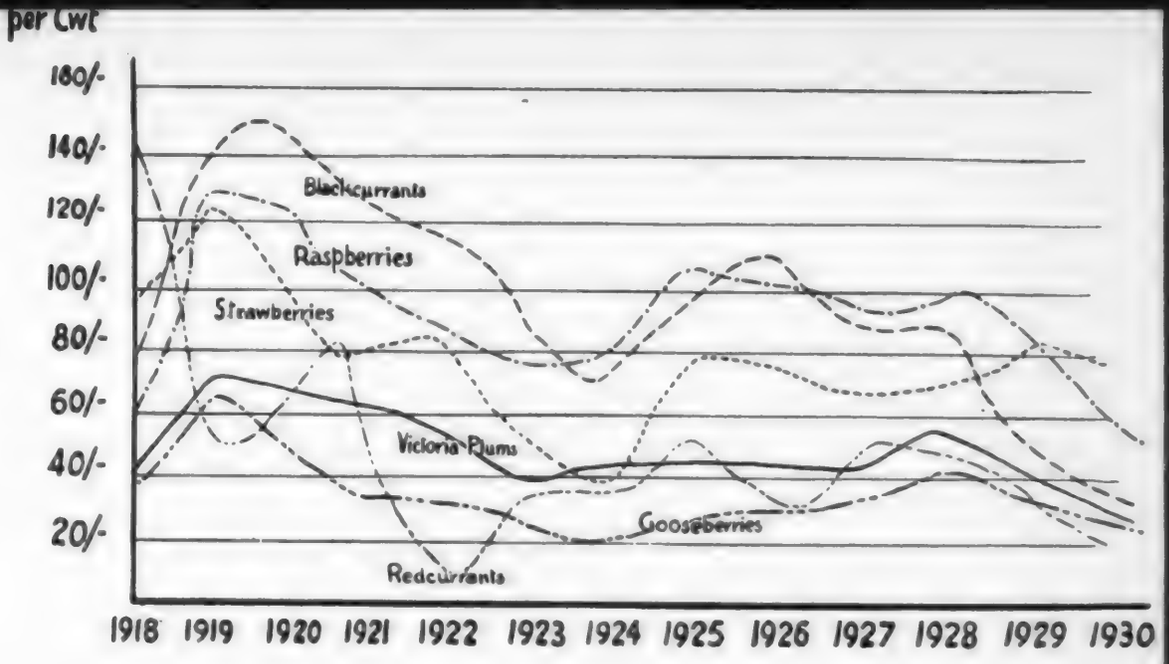
The Economic Depression, 1930-31

This analysis of costs gives an insight into the amount of capital required for even a small holding. For the first two years, until a crop of fruit is obtained, at least £300 capital is required for five acres of rasps. The table also gives an insight into the extent of the economic loss caused by the price depression during the years 1930 and 1931. During these years prices did not rise above £15 per ton for jam fruit—representing an average los of nearly £10 per ton. While the small-holders to a certain extent protected themselves by a greater concentration upon the fresh fruit market, their inability to pulp and their greater relative dependence upon raspberry growing meant that the incidence of the depression fell most heavily upon them.

What were the causes of this depression in prices? Contraction of demand, over-production, increased foreign competition, manœuvrings of middlemen, and inter-competition between growers great in number but weak in financial resources and eager to dispose of a perishable commodity, have all been blamed. An analysis of these asserted causes proves conclusively that several of them are without foundation. Thus dumping from the Netherlands and the U.S.S.R. found many adherents. Yet during these years the imports from the Netherlands were actually less than they had previously been. Thus in 1925 they were 2,875 tons; in 1926, 2,730 tons; in 1928, 2,000 tons; whereas in 1929 they fell to 1,800 tons, and to 1,400 tons in 1930, though it is to be admitted that in 1931 they rose to 2,400 tons, a considerable increase from 1930, but still less than the imports for 1925 and 1926. This increase was due largely to the loss of the German market to the Dutch growers—exports to Germany from the Netherlands fell from 4,000 tons in 1930 to 1,500 tons in 1931. The Empire Marketing Board estimated the import of raspberry pulp from the U.S.S.R. in 1930 at less than 600 tons. There is therefore little ground for believing that increased foreign imports were the major cause in bringing about the price depression, though exceptional circumstances abroad no doubt prolonged it. In normal times, in years of bad prices, imports fall off. This did not ensue in 1931.

The charge against the middlemen seems to have had its origin solely in bitterness—someone had to be blamed, and during the depression the dealers were in a most unenviable position. While it is no doubt true that marketing organisation could be made more scientific, there is little evidence to support the assertion of exploitation on the part of the dealers. The weakness of the producers is certainly a factor making for fluctuation in prices, but this is no new feature in the industry, and cannot be the cause of the catastrophic decline in 1930. Examination of the relevant factors lends support to the conclusion that the fundamental cause is to be found in the increase in acreage, coupled with increased output per acre, at a time when demand was contracting. So far as demand is concerned, between 1907 and 1930 the Census of Production reveals that the output of jam increased by 13 per cent. If this be taken as a criterion of the increase in demand, then it will be found that, while demand for jam increased but slightly, the potential output of raspberries in Great Britain increased during the same period by 100 per cent. If raspberries had merely usurped the place formerly occupied by other jam fruits, there would have been no cause for alarm, but

* *I.e.*, ⅓ of total cost.



Fluctuations in the price of dessert fruit, 1918-1930.

there is evidence to show that in the post-war years the demand for raspberry jam was actually declining. It appears therefore that the increase in output in Angus and Perthshire after 1925—for there was relatively little increase elsewhere in Great Britain—was the primary cause of the crisis in 1930, especially when the variety planted was the heavy yielding Lloyd George. Throughout the period general prices were declining—a contributory cause.

The Case for a Raspberry Marketing Board

If this is the case, what can be said for a raspberry marketing board for Scotland? Much has been written on this subject, but too little attention has been devoted to this vital factor, arising from its inability in a direct manner to control acreage. One fundamental factor making for fluctuation in prices is outside its control—namely, supply. Further, the demand for raspberries depends to a large extent upon the price of other fruits, the jam manufacturers changing their demand between the various fruits according to their relative prices. The above chart shows the fluctuations in the price of dessert fruit, and can be taken as giving a rough indication of the conditions prevailing in fruit marketing:

With such fluctuations in other fruits it is extremely doubtful if a raspberry marketing board in Scotland could do much to stabilise prices. It could, however, do something to counterbalance the weakness of the small growers, and it could organise and develop markets in a scientific manner.

In these ways it could do much to render conditions within its own industry more stable, and if growers of other fruits took similar steps to put their house in order, much would have been done to place fruit growing in Great Britain on a scientific basis. The grower must not stop short at production; his livelihood depends even as much upon distribution. While the development of a canning industry in Angus and Perthshire has done much to remove the suffering caused by the depression of 1930-31, the fundamental causes making for depression still exist. There is nothing to guide the growers and prevent blind expansion which may result in an even greater depression than that experienced during 1930-31. The cost of planning is negligible compared with the cost entailed by the want of planning.

Interior of a fruit canning plant at Grimsby, Ontario.

(Courtesy of the High Commissioner for Canada.)

Prices of Dessert Fruit in England, 1918-1930

(Compiled from Ministry of Agriculture Official Statistics.)

Description	*Quality.*	1918.	1919.	1920.	1921.	1922.	1923.	1924.	1925.	1926.	1927.	1928.	1929.	1930.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Currants, black, per cwt. ...	1	64 0	139 0	152 6	135 6	117 0	94 6	69 6	105 6	111 0	79 6	87 6	53 0	39 0
Currants, red, per cwt. ...	1	35 6	69 6	66 0	62 0	51 0	38 0	40 6	55 6	53 0	49 0	61 6	42 0	33 0
Gooseberries, per cwt. ...	1	30 0	60 6	46 6	31 6	30 6	24 6	21 6	33 6	26 6	35 0	46 0	38 6	30 0
Plums, Victoria, per cwt. ...	1	152 6	44 0	62 0	81 0	11 0	48 0	44 6	59 6	26 6	55 6	50 6	45 0	23 6
Raspberries, per cwt. ...	1	42 0	126 0	121 4	105 0	91 0	79 4	77 0	109 8	105 0	91 0	102 8	93 4	65 4
Strawberries, per cwt. ...	1	87 6	121 4	107 4	77 0	88 0	56 0	44 4	84 0	81 8	67 4	69 8	102 8	91 0

Acreage under Raspberries, 1913-1932

(Compiled from Agriculture Statistics Issued by The Ministry of Agriculture and The Department of Agriculture for Scotland.)

Year	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932
England	6,980½	6,933	7,384	7,795	6,683	6,522	6,000	5,872	6,452	6,143	6,827	7,557	6,906	6,645	6,471	6,156	5,975	6,522	6,137	5,867
Scotland	2,476	2,554	2,678	2,808½	2,674½	2,517	2,458½	2,557¾	2,698	2,878½	2,945¾	2,941½	3,152¼	3,527	3,805	4,062	4,276	4,561	4,581	4,715
Perthshire	1,865¼	1,953	2,099¼	2,254½	2,516¾	2,065¼	2,010½	2,050¾	2,080¾	2,168¼	2,205¾	2,127¾	2,215¾	2,427	2,481	2,624	2,772	2,896	2,883	2,898
Angus	180¼	193¾	190¾	177¾	176	170½	184½	250	342¼	391¼	423¼	461	549¾	711	825	889	924	1,073	1,085	1,194

A Kentish strawberry field.

(Courtesy of Broome and Green.)

Chocolate Fat Bloom

Harold Morgan, M.Sc.,
discusses Whymper's book on Chocolate Fat Bloom recently published in America.

THE PROBLEM of bloom is the bogey of the chocolate industry. Few foodstuffs are of so delicate a nature as is chocolate, liable as it is to exhibit unpleasant symptoms at most unexpected and inopportune moments. Unfortunately there appear to be several causes which produce that all too familiar grey look. However excellent may be the manufacturing methods and the condition of the product leaving the factory, the influence of subsequent environment may bring about physical changes in constitution to the detriment of its appearance.

The fat is the trouble-causing ingredient, and when for the moment we consider the constitution of cocoa butter (or any substitute), it will be realized that it has in its make-up inherent vices which necessitate very careful handling and control. Cocoa butter is not a single substance. It is a mixture of glycerides, each of which melts at a different temperature. The extent of the range covered by the varying melting temperatures can be gauged when it is learnt that one fraction has been isolated which melts at 12° C., while another melts at 42° C. This fact alone is sufficient reason to emphasise the possibility of difficulty being encountered when handling such a complex substance.

Another factor is the extraordinary property of melted cocoa butter under certain circumstances of cooling down below its setting-point without assuming a crystalline state. Although the average setting-point is in the neighbourhod of 85° F., it can be cooled without agitation even as low as 62·5° F. and still remain liquid.

Various suggestions have been made, tentatively, as to the cause of fat bloom, which can appear almost immediately after manufacture or at a considerably later date. Whymper, in his recent book on *The Problem of Chocolate Fat Bloom*, appears to be the first who has assigned a definite reason for this trouble, backed up by a considerable amount of reasoning based on actual experimental and industrial investigations.

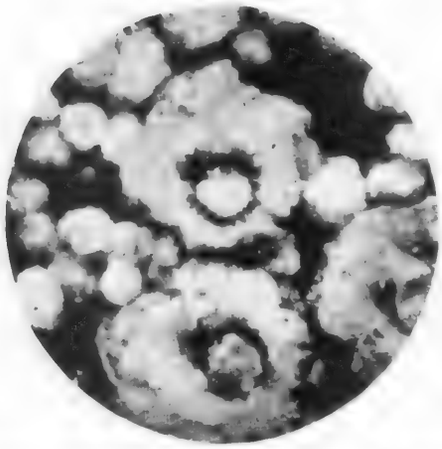
This newly published work deals with such subjects as the fractions of cocoa butter, melting-points, hydrogenated cocoa butter, nut fat bloom, solidification curves, viscosity, super-cooling, tempering and cooling—covering some 100 pages—and is followed by 25 pages of practical considerations.

The first part is essentially scientific in nature, and while it suffers to some extent from repetition, which is admitted by the author in his preface, one is not allowed to lose sight of what in Whymper's opinion is the cause of fat bloom—viz., some of the higher melting fractions of cocoa butter. In a joint paper with Bradley, published in the *J.S.C.I.* in 1925, the authors maintained that it was the higher and not the lower melting fractions which constituted the crystals forming bloom. Subsequent work reported by Whymper in this book confirms that original view, and the assertion is made that some of the higher melting fractions alone are the cause of the trouble.

A fat of which all the fractions are in a definite crystalline condition should be stable, and normally would not be expected to bloom. However, in cocoa butter certain fractions are still liquid at normal temperatures, and, when it is cooled and apparently set, some, but not all, of the higher melting fractions have crystallised. The crystals which have solidified out are merely suspended in a more or less liquid medium which holds in solution a further proportion of the higher melting fractions. Thus crystal growth can proceed from such nuclei as very small crystals of these fractions. Fluctuating temperatures at which the finished goods are stored provide ideal conditions for further separation, or growth of high melting fractions especially. The presence of high melting crystals in bloom has been demonstrated by microscopic observations of their melting-points under very carefully controlled and accurate conditions.

While the ideal condition of complete crystallisation of all fractions is not practicable under industrial conditions (for instance, such a chocolate would have a very dull appearance), the essential preliminary operation in preparing chocolate for use in the enrober or depositor is to ensure that as much as possible of the higher melting fractions are in a crystalline condition before the chocolate is used in the covering or moulding process. By this means any subsequent tendency for crystallisation of these fractions to take place is reduced to a minimum, and with suitably slow cooling the chocolate will be set in such a manner that it will stand up to normal conditions of handling and storage.

The preliminary treatment comprises what is usually termed "tempering," and the principle involved, as given by Mr. Whymper, is as follows—"conching or heating



An extreme case of acute bloom induced by harsh treatment in the laboratory, showing circular clusters and nodules of separated and congealed fat, with craters. (Magnification- 15 diams.)

A typical example of the powdery or "grape-bloom" type of chocolate fat bloom, commonly seen on nut-pieces and chocolates, showing delayed bloom. (Magnification—300 diams.)

Reproduced from Whymper's "Problem of Chocolate Fat Bloom," discussed in the present article.

and stirring for prolonged periods at the highest temperature at which any of the higher melting fractions can separate out, and a slow reduction of that temperature with constant agitation before the chocolate is used for covering, seem the only likely ways of preventing bloom."

Dealing with covering chocolate it is stated that the temperature of a chocolate at the time of covering is only important in so far as it is one factor controlling the condition of the fat at that time and at that temperature, and that the consistency of a chocolate at the time of covering, or its condition judged by its cooling curve, is a far better and truer indication of what will happen to that chocolate subsequently than ever its temperature of covering can be.

Whymper points out that the tendency is to cool the centres too quickly. The rate of cooling chocolate, from the temperature point where it reaches a maximum due to evolved heat of crystallisation from the separating fatty fractions, down to the final temperature of the cooling room, is of fundamental importance as far as bloom or delayed crystallisation is concerned. The writer is in entire agreement with this statement, for frequently cases of bloom have to be dealt with arising from a desire to increase output at the expense of cooling time. Quickly cooled chocolates usually have a very attractive shiny appearance, even more so than a correctly tempered and cooled chocolate, but the possibility of delayed bloom is ever present.

The writer is not aware that anyone has previously assigned the cause of bloom to some of the higher melting fractions of the fat. It has been claimed that the proportion of low melting glycerides is the chief origin of surface instability in chocolate, since their liquefaction in warm weather permits the separation there of visible crystalline matter of higher melting glycerides. But on cooling again, surely the bloom is composed of all melting-point fractions. Our tests carried out some time ago indicated that the melting-points of certain fat blooms were approximately that of cocoa butter. There is again the possibility of some distribution effect due to volume change in the liquid to solid fractions and *vice versa*. The writer is aware that much work has been done privately on this important subject of fat bloom, and no doubt many investigators will not see eye to eye with Mr. Whymper as to the actual cause of the trouble. For instance, are the higher melting fractions the actual cause of the bloom, or are they the visible result of other causes? This matter is of such a fundamental importance to the whole chocolate industry that it needs a thorough ventilation of all views, and what medium can better answer the purpose than the pages of FOOD MANUFACTURE.

The use of lecithin in chocolate manufacture is now well appreciated by Mr. Whymper, who deals with the reduction in viscosity and the stabilising effect of this substance. A practical problem which will be met with in endeavouring to carry out the precept of crystallising a high proportion of the higher melting fractions before use will be the danger of increased viscosity. A definitely stabilised chocolate will be necessary to obtain full advantage of the suggested procedure.

Pichard has done valuable work on the cooling curves of fats, and his methods have been followed with more or less modifications by many others. The results obtained have been of immense value, particularly from an analytical and comparative point of view. The method advocated by Mr. Whymper is a distinct improvement, as information is obtained in a manner scientific and yet of actual direct practical value. The conditions under which the test is carried out are those of the factory itself, and it is presumed that much valuable information could be obtained in the laboratory by reproduction under somewhat similar conditions.

The Problem of Chocolate Fat Bloom is a work that will be carefully studied by everyone who appreciates that the necessity of getting to the root of a trouble is the only way to conquer it. As mentioned before, there are divergent views on the subject, and Mr. Whymper must be congratulated for being the first to present his ideas in such a clear and comprehensive manner on so thorny a problem.

pH Without Tears

By C. A. Redfarn, B.Sc., Ph.D.

It is absolutely essential that everyone concerned with the production side of the food industry should have more than a nodding acquaintance with the term pH—that is, if he wishes to keep in step with technical advance.

Believing that it is possible for the person who does not profess high chemistry and mathematics to enter into more friendly relations with pH, based on better understanding, we asked Dr. C. A. Redfarn to try his hand at a simple explanation. This is the result, and to us, at least, it appears to meet the case very well.

THE TERM *p*H has in recent years emerged from its academic seclusion and become the fashionable synonym for acidity in many industries. While it is impossible to explain exactly what *p*H means without plunging into mathematical symbols, it should be possible to give, by the use of everyday language, a working idea of what the concept implies.

In the first place, it is necessary to define what is meant by the word *acid*. All acids, when dissolved in water, have the power of splitting up into two different sets of particles, each particle carrying a charge of electricity. Since there are equal amounts of the two different kinds of particles present, and since one sort carries a positive charge and the other a negative charge, the net result is that the solution has no apparent charge, for the positive charges neutralise the negative ones. For example, hydrochloric acid splits up (or dissociates) as follows:

$$HCl \longrightarrow H^+ + Cl^-.$$

Sulphuric acid: $H_2SO_4 \longrightarrow H^+ + H^+ + SO^-{}_4{}^-$.

Acetic acid: $CH_3COOH \longrightarrow CH_3COO^- + H^+$.

It will be noticed that in each case the acid gives rise to a positively charged hydrogen particle which is called the *hydrogen ion*. In fact, it is the property which certain substances have, when dissolved in water, of giving rise to these hydrogen ions, which gives these substances their acidic properties. That is to say, an acid may be defined as a substance which will give hydrogen ions (positively charged hydrogen particles) when dissolved in water. The degree of acidity or the effective acid strength of a solution depends on the amount of these positively charged particles present, or, in other words, on the *hydrogen ion concentration*.

Another important point with regard to acids is that they do not split up (dissociate) to the same extent. For example, a typically "strong" acid like hydrochloric acid is, in dilute solution, almost entirely split up into positively charged hydrogen particles, and an equal number of negatively charged chlorine particles. It should be noted that these charged particles do not have the ordinary chemical properties of the ordinary uncharged particles of hydrogen and chlorine. A typically "weak" acid such as acetic acid is, in dilute solution, only partially split up; about 4 per cent. of the acid is split up into H^+ and CH_3COO^-. From this it will be seen that if a comparison is made between solutions of hydrochloric and acetic acids of equal strengths as regards the amount of each compound present in their respective solutions, the hydrochloric acid solution will be twenty-five times as acid as the acetic acid solution. In other words, the hydrochloric acid is almost 100 per cent. dissociated while the acetic acid is only about 4 per cent. dissociated, so there will be twenty-five times more hydrogen ions in the hydrochloric acid solution than there are in the acetic acid solution. Each particular acid has its specific *dissociation value*.

When an acid is titrated with standard alkali in order to determine its acidity, the result obtained does not give the amount of charged hydrogen particles present, but gives the total amount of acid present; that is, the split-up part plus the part not split up. Hence, with the acid solutions considered in the previous paragraph, the titration method would indicate that they were of equal acidity.

The titration method measures the total acidity, while the pH scale has been evolved to give a measure of the effective acidity.

An alkali or basic substance may be considered as the opposite of an acid, since an alkali, if added to an acid, will neutralise its acidic properties. When an alkali is dissolved in water it splits up into two charged particles, thus:

$NaOH$	$\longrightarrow$	Na^+	$+$	OH^-
Caustic soda.		Sodium ion.		Hydroxyl ion.

The specific property of all alkaline substances is that when dissolved in water they give rise to negatively charged particles consisting of oxygen and hydrogen combined together, known as *hydroxyl ions*.

Pure water is dissociated (split up), to a slight extent,

into equal amounts of charged hydrogen particles and charged hydroxyl particles:

$$H_2O \longrightarrow H^+ + OH^-$$

Water. Hydrogen ion. Hydroxyl ion.

It will be observed that water contains the essential parts of both an acid and an alkali. As they are present in equal amounts, pure water is therefore neutral. It contains 7 units (or parts) of hydrogen ion and 7 units of hydroxyl ion, making a total of 14 units of ions present. It is not possible to discuss what these units are without delving into mathematics, so it will suffice if they are considered as very small quantities. It has been found experimentally that no matter what is done to water, the *total* amount of H^+ and OH^- ions present always adds up to 14.

When an acid is added to water, this amounts to the addition of charged particles of hydrogen. Since there can never be more than a total of 14 units of H^+ and OH^- present, it follows that the amount of OH^- in the water must decrease. This is effected by some of the OH^- combining with some of the H^+ to form water, $OH^- + H^+ \longrightarrow H_2O$, until there is a total of only 14 units of H^+ and OH^- left. For instance, such an acid condition can be represented by, say, 10 units of positively charged hydrogen particles plus 4 units of negatively charged oxy-hydrogen particles. The solution has no apparent electrical charge because there are other ions present which neutralise the excess of positive charges without interfering with the acidity of the solution.

Similarly, if an alkali—that is, OH^- ions—is added to water, some of the H^+ ions must go in order to keep the total number of OH^- and H^+ ions down to 14 units. Here an alkaline solution can be represented by, say, 10 units of OH^- ions plus 4 units of H^+ ions. To extend this to the general case, solutions containing from 13 to 7 units of hydrogen ions are acid, while those with 13 to 7 units of hydroxyl ions are alkaline, neutrality being represented by 7 of each.

It will be realised that the following conditions can obtain in water solutions: (1) $13H^+ + 1OH^-$, (2) $12H^+ + 2OH^-$, (3) $11H^+ + 3OH^-$, (4) $10H^+ + 4OH^-$, (5) $9H^+ + 5OH^-$, (6) $8H^+ + 6OH^-$, (7) $7H^+ + 7OH^-$, (8) $6H^+ + 8OH^-$, (9) $5H^+ + 9OH^-$, (10) $4H^+ + 10OH^-$, (11) $3H^+ + 11OH^-$, (12) $2H^+ + 12OH^-$, (13) $1H^+ + 13OH^-$, and, of course, intermediate values like $3{\cdot}4H^+ + 10{\cdot}6OH^-$. The conditions occurring in example (1) are described as a solution of *p*H equal to 1, in example (2) *p*H is equal to 2, and so on. That is, *p*H 1 to 7 is acid, *p*H 7 to 13 is alkaline, and *p*H equal to 7 is neutral.

There has been a certain amount of twisting of the facts in order to obtain this non-mathematical representation of the *p*H scale. While apologies are due to such readers as could have followed the logarithmic explanation, had it been presented, non-mathematical readers can rest assured that the explanations given, while not strictly true, are close enough to the facts for all practical purposes.

There are on the market indicator solutions which have the power of exhibiting definite colours for the different *p*H values on the scale. These solutions are used when moderately accurate determinations are good enough, but for exact determinations special electrical apparatus must be employed.

INTERNATIONAL CONGRESS IN PARIS

By special invitation the British food industries were represented at the International Congress of Agricultural and Food Chemistry, held in Paris from the 25th to the 31st of March, by Food Manufacture in the person of Mr. Leonard Hill, the proprietor of Food Manufacture and other papers, accompanied by the Editor, Dr. H. B. Cronshaw.

The Congress was a brilliant affair and was attended by the President, members of the Foreign Office and the Ministry of Agriculture, as well as other members of the Government.

The French food industries gracefully acknowledge the help which they have received from the information disseminated by Food Manufacture.

CANNED MEATS (continued from page 125)

Gelatine at the dilution at which it exists in canned meats has a definite melting point. "Nor all thy piety nor wit" will make it do otherwise. Substitutes for gelatine are possible, but the results are not picturesque nor reasonable in price.

Complaints may be made about the darkening of the meat on keeping. This is solely due to loss of moisture. Maximum moisture and reasonable fat content will avoid it.

The vacuum in the can should be a high one and the sides perfectly collapsed. The tinplate should be as light as possible compatible with safety. Vacuum sealing (with its own little incidental worries and problems) is the best method of securing vacuum, but the same effect may be obtained by sealing at the necessary temperature.

The cans used for such products as corned beef are generally unlacquered. There will inevitably be a slight blackening on the inside surface of the can, but the meat should be free from this. A heavily blackened surface is a bad sign and points to defects in manufacture, although the actual black substance—iron sulphide—is not harmful in the extremely small quantities in which it occurs.

Industrial News

INTERNATIONAL SUGAR CONFERENCE — CASKS FOR FOODSTUFFS — THE IMPERIAL FRUIT SHOW—AUTOMATIC EQUIPMENT—FACTORY LIGHTING

New Pfaudler Factory

The manufacture of Pfaudler glass-lined equipment for the British market has been transferred to a new factory recently built and fully equipped at Leven in Fifeshire. The factory covers an area of about 2½ acres, but future extensions have been taken care of by the acquisition of adjoining land. The new buildings are an attractive example of modern factory architecture and are extremely light an airy.

The general plan of the factory takes the form of a letter L, both extremities of which are served by the company's railway sidings, thus permitting raw materials to be brought into the works at one end and the finished equipment to be taken out at the other. The tank shop is well supplied with "rolls," shearing, punching and drilling machines, and a fine high-speed welding plant has also been installed. Nearby are the grinders and sand-blasting rooms where the tanks are prepared for the enamelling department. An inspection of the sand-blasting rooms revealed a comparative freedom from the usual dust-laden atmosphere, and we were informed that the rooms have been constructed according to an improved design in order that a ventilating system could be installed which completely changes the air at the rate of from four to five times per minute.

In the enamelling department our attention was particularly attracted to the large furnace which rises to a height of nearly fifty feet. Its design and construction are quite new, and, in conjunction with an unique tank-handling crane for placing the tanks into and removing them from the furnace, presents a most ingenious arrangement. Gas for the furnace is produced by the company's own plant, and like much else in the factory, is almost automatic.

The factory will also have the benefit of a well-equipped machine shop, pattern shop and foundry, as well as its own railway rolling stock and electric power generating plant. We are also interested to learn that practically the whole of the factory and its equipment has been drawn from British sources, so that henceforth Pfaudler equipment will be made by British workmen and machines from British materials in a British factory.

Change of Address

An announcement of considerable interest to a large number of readers is that Dewey and Almy, Limited, have now removed to a more central position, at Shell-Mex House, Strand, London, W.C. 2. Their telephone number is Temple Bar 1410, and the telegraphic address "Darexeng Rand London."

Messrs. Dewey and Almy believe that taking offices in such a central position will enable them to be of still greater service to the industry.

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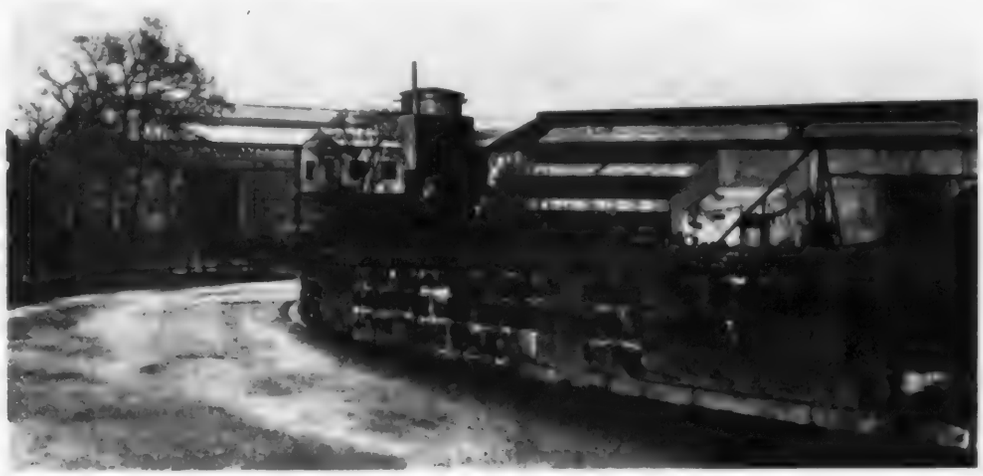
International Sugar Conference

The sugar-producing countries of the world, anxious to find a way out of their present difficulties caused by unsaleable surplus supplies and low prices, met to discuss their problems in London during March.

The British sugar-producing colonies were represented by the Earl of Plymouth (Parliamentary Under-Secretary for the Colonies), the United States by Embassy officers with a spokesman for the Philippines. Other countries represented were Holland, Java, Cuba, Poland, Germany, Hungary, Belgium, Czechoslovakia and Peru.



A general view of Pfaudler's new factory at Leven in Fifeshire.

Casks for Foodstuffs

An excellent booklet is issued to the trade by the Guelph Patent Cask Co., Ltd., of Millwall. Describing the Guelph casks, it states that the ordinary cask is made of two layers of veneer, so placed that the joints in one layer are covered by the staves of the other layer. The hoops (also of veneer) vary in number and thickness with the size of the cask, and are secured so that they cannot possibly be torn away.

The head, in two or three pieces, is easy to close and tight fitting. Single-piece three-ply heads can also be supplied, as for certain uses they have proved more suitable.

The ordinary Guelph cask can be used for most dry goods—seeds, spices, biscuits, and similar commodities, and for materials like soft soap and paste.

For finer materials, as powders, dyestuffs, etc., greaseproof-paper bags or cardboard linings can be supplied. With the latter, the chimbs are filled with cotton cord, making the cask absolutely silt-proof. For liquids, or materials which deteriorate on exposure, a tin lining is provided. When exceptional strength is required, the end hoops can be supplied with iron bands, and the heads with battens.

All cask problems, in short, may with advantage be referred to this company, who have had wide experience in the business for over fifty years.

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A Boxmaking Novelty

The combined thermometer, waterproof flower vase, perpetual calendar, and paperweight, which is illustrated below, is only one instance of the striking originality and versatility of Messrs. Robinson and Sons, Ltd., of Chesterfield, in the realms of boxmaking. Many readers will recall, for example, the in-

genious stand which the firm in question occupied at the recent Fair at Olympia. It was built up of actual boxes—white, silver, and black. The comprehensive "museum" of boxes on show at that stand was, incidentally, one of the packaging "high lights" of the Fair.

The 14th Annual Imperial Fruit Show and Canners' Exhibition will be held at the Granby Halls, Leicester, from Friday, November 2nd, to Saturday, November 10th, 1934, and a prospectus and plan will be issued to all previous exhibitors in the near future.

The Show has been held in Leicester once previously, in 1930, when a great success was achieved.

The City has the advantage of one of the best halls in the provinces for exhibition purposes (with a floor area of approximately 56,000 square feet) and is particularly well placed in regard to accessibility from the principal fruit-growing districts.

Automatic Equipment

We have received a folder from the Pneumatic Scale Corporation, Ltd., an engineering house well-known both in this country and in America, entitled "Equipment you need for packing dry or liquid goods." We quote herewith a list of the various adjustable automatic machinery described in this folder:

(*a*) *For Liquids, Semi-Liquids, and Light Powders.*—Adjustable Vacuum Fillers, semi-automatic to high speed. Adjustable Screw Cappers, single, four, and six head, with adjustable tension and automatic cap feed. Adjustable Corking Units—bridge or wheel. Adjustable Plugging Units.

(*b*) *For Tins and Drums.*—Net Weight Weighers. Volume Fillers (for abrasive and other powders). Cappers. Wet Labellers. Dry Labellers. Driers.

(*c*) *For Cartons.*—Carton Feeders. Sealers (top and bottom). Liners (wax paper, parchment, etc.). Weighers (net and gross). Volume Fillers (for abrasive and other powders). Tight Wrappers. Wax Wrappers. Labellers.

All the above are said to be adjustable to different sizes.

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Passion Fruit and Papaws

New South Wales is witnessing a revival in the cultivation of the passion vine for its fruit. It is found growing in a wild state as a fairly common plant in the scrubs along the north coast. As yet it is not extensively grown, but it is said to be a source of considerable profit to growers who specialise in it.

The papaw is another fruit to which increasing attention is being paid in N.S.W. The fruit may be used in chutney.

Prohibited Preservatives

Two samples of non-alcoholic wines were recently found by the Liverpool City Analyst to contain salicylic acid, the use of which as a preservative is prohibited by the Preservative Regulations. The acid has not been found in any article of food examined by the Analyst for some years past. The manufacturers were communicated with on the subject, and the retailers have withdrawn the old stock from sale.

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Factory Lighting

An ingenious light-testing device which should do a lot to settle the vexed question of "What *is* good lighting?" has recently reached us from Benjamin Electric, Limited.

The device takes the form of a kit of parts accompanied by a concisely worded booklet which describes the series of lighting tests which can be performed and points the lesson which is to be learned from each test. In spite of the variety of tests

which can be made, the entire kit folds into a stout kraft envelope and goes through the post as a letter.

If it had nothing to recommend it other than the interesting and unexpected demonstration of optical principles, the Kit would be worth securing, but in addition it reveals facts which are of vital importance to the economic and profitable running of every enterprise. The kit is available free on request to the makers.

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Sausage-Maker's Fortune

Mr. John Morgan, of Moorcroft House, Moseley, Birmingham, who died recently at the age of 67, left estate to the value of £112,637. He carried on a large business in Digbeth and was known locally as the "Sausage King." He was a member of the National Union of Manufacturers, of the Food Manufacturers' Association and also of the Sausage Manufacturers' Association.

INFORMATION and ADVICE

Biscuit Cracking—Soup and Gravy Powders Clarifying Juice—Sausage Making—Aerating Agent — Custard Powders — Sauces — Pickled Onions—Sandiness in Milk—Casein — Golden Syrup — Separation in Sauce — Tongue Loaf—Drying of Fruits and Vegetables—Pickled Beetroot—Cheap Chutney

Biscuit Cracking

1,547. *As regular subscribers to your journal we shall be very much obliged if you can supply information on the factors causing the cracking and breaking of biscuits after baking, otherwise known in the trade as "checking."* (London.)

This, of course, must be due to the uneven loss of moisture on drying and baking. If either is rushed so that the loss of moisture varies at different points throughout the mass of the body, it will be clear that stresses will be set up which will give rise to rupture, when they build themselves up beyond the resistance of the body.

It means that the drying and baking have to be carried out more carefully so as to avoid these stresses being set up and to ensure a reasonable uniform loss of moisture.

Of course, it is possible to increase the resistance of the body to stresses by modification of its texture and composition. In any case, the general idea is to cut down stresses by regulating the loss of moisture and to build up resistance of the body by adjustment of the texture and composition. This is a matter of balancing various factors.

Soup and Gravy Powders

1,548. *We should be glad to have some information concerning the manufacture of soup and gravy powders.* (Lancashire.)

The basis of dried soups is generally a mixture of two or more of the following flours—potato, corn, sago, pea, and lentil. The choice of these, and the proportions in which they are used, depends to a large extent on the type of soup being made. The other ingredients consist of salt, pepper, sugar, and vegetable powders.

The nature of the dried vegetables will, of course, be determined by the type of soup. Sometimes gelatin or milk powder is an additional constituent.

In one method the ingredients are heated, while stirring, in an iron pan, and then meat extract is dripped into the mixture, the stirring being continued until the whole is in a suitable condition for pressing into cubes.

As regards gravy powders, these generally consist of some sort of flour and caramel, together with salt. There is a considerable variation in the composition. The flour is usually either sago flour, potato, or rice flour, or a mixture of these. Sometimes flavouring materials are added, such as celery powder or an extract of meat.

The difficulty is the choice of the right grade of flour. The size of the starch granules is important. Then there is another difficulty in the mixing of the caramel with the other ingredients so as to obtain an even distribution of the caramel and to get a uniform and correct colouring.

Your best plan is to submit a sample of the gravy powder you propose to imitate and to get a food chemist to make you up a sample as near as possible to the original, or, better still, indicate just where you want the improvement to be effected.

Clarifying Juice

1,549. *There are one or two points about which I should like information:*

1. *The clarifying of syrup used in preserving peel and cherries. This is boiled in an open pan, as at present a vacuum pan is out of all question from a financial viewpoint. The syrup becomes dark, due to caramelisation. Will any method with charcoal or chalk, etc., clarify it to any extent?*

2. *Can you advise any particular filter to use with light syrups (about 20° Baumé) which contain particles of pulp from lemon and orange peel?*

3. *There is a commodity on the market as a substitute for glacé cherries. It is cut into small cubes. Could you say what it is actually made from, and the method of manufacture?* (Lancashire.)

1. You raise a very big subject, and it is really one to be dealt with by an engineer on the spot, as the proper answer really depends on a number of considerations, such as output, degree of clarity required, size and number of particles of pulp, and the general layout of your present plant.

It is possible to clarify caramelised sugar with decolorising charcoal, but the question as to whether this is worth while in your case is a matter which can only be settled by taking into consideration all the relevant points.

It may, for instance, be cheaper for you to discard the syrup when it becomes unduly darkened.

2. The question of the choice of filter for removing particles of pulp is one which we would settle by forwarding a sample of the syrup to makers of filters, and if the solid particles are extremely finely divided it may be necessary to use a filter aid. On the other hand, it may be possible to secure the desired degree of clarity by passing your syrup through a simple pulp filter or even a frame type of filter.

3. Various methods, using different raw materials, are in use. We gave the enquirer information on these points.

Sausage Making

1,550. *Have you any information on the use of a large-size cake machine for mixing minced meat, cereals, and seasoning for sausage? We are told that it makes a cooler and brighter mix than when the usual bowl type of machine is used.* (Bristol.)

Without actually trying it out and taking temperatures of any two machines chosen for comparison, it is hard for anyone to give a definite opinion on the matter.

Much depends on how the operations are carried out, and on the size and type of the mixer, and also on the size and type of the usual kind of bowl chopping machine employed.

In any case, it seems that if you use a cake mixing machine with the usual type of mixing arm you will have to pass your fat through a mincer, which seems bad practice. One cannot see how you can improve on the bowl chopper, passing the meat through a mincing machine, transferring it to a bowl chopper, and then adding the filler and spices and finally the fat.

If proper care is taken the temperatures during such an operation should not be in any way deleterious.

The only advice that can be given is to run two comparative trials and take temperatures. If the fat can be cut separately to the required size, it is almost certain that the temperature in a mixer not provided with knives would be lower than in a knife type of machine. The question is, Would the mixing in a cake mixer be sufficiently intimate in view of the nature of the ingredients being mixed? These points can only be settled by actual trial.

Aerating Agent

1,551. *We understand that amido-guanidine sulphate is used for the purpose of measuring and recording carbon dioxide evolved during dough fermentation. We should be glad to have some information on this subject.* (London.)

Mr. W. Brabender, of Duisburg, Germany, who is probably the foremost authority on this subject of measuring and recording the rate of fermentation in dough, informs us that he does not believe that amido-guanidine sulphate would prove suitable in this connection. It is split up into carbon dioxide, ammonia, and hydrazine on coming into contact with dilute acids or alkalies—*i.e.*, under the conditions of fermenting doughs. Mr. Brabender thinks that amido-guanidine might be used as an aerating agent, as, for example, in connection with the compounding of self-raising flours.

Custard Powders

1,552. *I shall be pleased if you can give me some information on the preparation of custard powders.* (Lancashire.)

This has been discussed on several previous occasions. Custard powders are usually made from cornflour, arrowroot, sago flour, or rice flour, or mixtures of these, coloured and flavoured. Probably cornflour is the best, although some claim that sago flour is the best because of its ready jellying power.

The whole art of custard powder making consists in obtaining a uniform mixture of the colour and flavour with the flour base. This is done in various ways. The colour and flavour may be ground with a fraction of the flour and then mixed with the rest of the batch. A solution of the colour or flavour may be mixed with part of the batch, which is then dried and ground and mixed with the rest in two or three stages. Thirdly, the colour may be sprayed into the flour by a Gardner type of mixer.

Recently, what appears to be an improved method of making custard powders is to purchase the colour and flavour base already prepared and simply mix it with the flour.

Sauces

1,553. *We are a firm just commencing business, and we are anxious to secure a good publication on the manufacture of sauces. Can you recommend us one?*

We are also desirous of obtaining good recipes for lines of fruit, spice, tomato, and Worcester sauces, as we feel that those in our possession can be improved on, and we should appreciate any assistance you can give us in this direction. Preparation is on a moderate scale. (Sussex.)

This question of the manufacture of sauces is a difficult one, as without some actual experience mere recipes are not much use. By far your best plan is to get the help of a practical chemist to make up samples to your requirements, and start you off on the actual manufacturing side.

In the first place, you are recommended to read a general article published on the subject in the March, 1933, issue of FOOD MANUFACTURE. In that there is an example of a recipe for fruit sauces.

There are dozens of recipes for sauces, and the choice really depends on a number of circumstances, especially the one of price. Hence, to give you a recipe is only like making a shot in the dark.

You might, for instance, try your hand at the following, which is a fairly cheap product:

Dates	1½ boxes
Apple pulp	2 gal.
Tomato pulp	1 ,,
Onions	18 lb.
Garlic	2 ,,
Salt	4 ,,
Cayenne	1½ ,,
Ginger	1½ ,,
16-grain malt vinegar	26 gal.
80 per cent. acetic acid	½ ,,

Peel and chop onions and garlic. Mix the ground spices to a thin paste with water and allow to soak for 48 hours. Simmer all ingredients for 30 minutes, then pass through a fine sieve. Bottle at over 185° F.

If you have any particular difficulties we shall be glad to render some assistance.

As regards tomato and Worcestershire sauces, these are much more difficult products to prepare than ordinary fruit sauces. For tomato sauces you would require to sterilise the bottles after they have been filled and capped.

In the case of Worcestershire sauces, these are complicated in their composition, and the only possible satisfactory way is to get a chemist or experienced sauce maker to give you some practical instruction.

If you decide to go on with the manufacture of tomato sauce, we could give you some general instructions.

Pickled Onions

1,554. *I have to acknowledge receipt of your letter of the 9th inst., and thank you for the information you sent me.*

My trade here is for the cheap class pickles, and I am given to understand that it is not necessary to give the onions so long as between 16 and 21 days, and then a further 10 days in brine with the preservative, as is usual in the better class pickling trade, and I would be obliged if you could give me any information and advice on the short period brining and preservative process, which I have been informed is only a matter of 2 to 3 days for both processes, in the case of cheap pickle trade.

I am new to this class of business, and any advice you can give me will be greatly appreciated.

My chief trouble is only in the pickled onions, and these show a sediment at the bottom of the jar, also the onions seem to have a fine superfluous skin adhering to them, and this is the difficulty I am trying to overcome.

You mention ½ oz. bisulphate of lime as a preservative added to the second brining? (Liverpool.)

For the preparation of cheap pickled onions, some people simply peel the onions and put them in a 4½ per cent. solution of acetic acid, together with ¼ oz. salt to each gal. They are allowed to stand for 48 hours, after which they are filled into containers.

Another method is to peel the onions and place them in a brine, consisting of 2½ lb. salt to the gal., adding benzoate of soda in the amount equivalent to 2 oz. to the 50 gal. Allow to stand for three days, after which they are filled into containers.

Do not use sulphite of lime, as it bleaches the vinegar.

Sandiness in Milk

1,555. *Will you kindly give some information as to the cause of sandiness in condensed milk?* (England.)

A note was made on Segal's work in the January, 1931, issue of FOOD MANUFACTURE.

According to Segal (*J. South. Afr. Chem. Inst.*, 1930, p. 333), sandiness in sweetened condensed milk is attributed to supersaturation with respect to lactose. The size of the lactose crystal is important, and is related to the method of cooling. The author showed mathematically that the texture of the condensed milk is a function of the size of the lactose crystal. A formula is given with which the number of lactose crystals per cubic mm. of condensed milk can be calculated. From the manufacturing point of view, it is considered necessary to have a method of cooling in which a large number of crystal nuclei are formed at once rather than the gradual growth of crystals round a small number of crystal nuclei.

From this it would appear that cooling after condensing should be conducted in such a manner that no opportunity is given for the formation of relatively large crystals, the object being to induce crystallisation of the lactose in minute crystals at a multitude of centres.

It would seem also that viscosity plays a part in determining the crystallisation of lactose.

This aspect of the subject has been treated by Alan Leighton and Abraham Leviton of the Research Laboratories, Bureau of Dairy Industry, U.S. Department of Agriculture, Washington, D.C., in a paper entitled "The Effect of the Diluting Action of Cane Sugar upon the Viscosity of the Colloidal Suspension Skim Milk," which was published in the *Journal of Physical Chemistry*, vol. 36, 1932, pp. 523-528.

Leighton and Leviton showed that the addition of an optimum quantity of cane sugar to skim milk before condensing reduces the viscosity of the concentrated product to the point where lactose crystallisation can take place readily, and where separation of the milk sugar crystals by means of mechanical means is feasible.

Their idea to overcome this difficulty of sandiness or cloudiness was to induce the crystallisation of the lactose, at the same time reducing the viscosity by the addition of cane sugar to such a point that the degree of viscosity would permit of separation of a high percentage of the lactose by mechanical means. Attempts to separate any considerable amount of lactose from skim milk do not appear to have been successful, owing to the fact that skim milk concentrated to a degree which will permit of separation of a high percentage of the lactose is so viscous that the lactose crystals cannot be mechanically separated from the mass.

Furthermore, the viscosity of highly concentrated skim milk tends to increase rapidly with time. Their idea was that the addition of cane sugar to skim milk might, upon the concentration of the milk, so dilute the concentrated product, lower its viscosity, and retard thickening, that even when a concentration was attained sufficient to crystallise a considerable portion of the milk sugar, a viscosity would result sufficiently low to permit of its mechanical separation from the milk. This addition of cane sugar would, of course, compensate, in part at least, for the lactose separated out.

Leighton and Leviton conducted experiments, and they found that 240 gm. of cane sugar and 4,000 gm. of skim milk was a satisfactory proportion.

They found also that the amounts of lactose that can theoretically be separated out at 15° C. from skim milk of varying concentration were as follows:

Skim Milk. Parts Solid to 100 of Water.	*Per Cent. of Milk Sugar Separable.*	*Skim Milk. Parts Solid to 100 of Water.*	*Per Cent. of Milk Sugar Separable.*
70	53·2	130	74·8
100	67·3	160	79·5

The addition of cane sugar is, of course, made before the condensing operation.

This phenomenon of viscosity reduction can be attributed to the diluting action of the cane sugar on the basis that the dissolved sugar markedly increases the volume of the liquid phase of the suspension.

Casein

1,556. *What trades use talc powder? Also what trades use ground casein?* (Glasgow.)

Talc powders are used in preparing toilet preparations, such as talcum powders and face powders and in making French chalk in crayon form. It is stated that about 90 per cent. of the mined talcum is ground to flour and used in the manufacture of opaque paper, moulded rubber goods, foundry facings, and in the roofing trade.

Casein is used for a great variety of purposes, such as the following: Adhesives, glues, putties, cements; sizing, enamelling, water or grease proofing, etc., of paper; the preparation of moulded products, such as artificial stone, ivory, bone, etc.; in the textile industry for the preparation of mordants, size, loading agents, etc.; for special paints; in the preparation of certain proprietary foods, as, for example, its incorporation with glycerophosphates and other special uses in the food industry. It is also used in medicinal preparations and for a great variety of other purposes, including its incorporation as a spreader for sprays, shoe polishes, creams, and pastes.

It is impossible to give anything like a satisfactory account of its manifold applications in the course of correspondence. You would be well advised to consult the following textbooks: *Casein: Its Preparation and Technical Utilisation*, by Scherer; *Casein: Its Preparation, Chemistry, and Technical Utilisation*, by Tague.

Golden Syrup

1,557. *I have been a subscriber to your magazine more than two years now, but I have never before seen mentioned therein Golden Syrup. You have such reference in your January issue on page* 36.

Will you be good enough to favour me with detailed *manufacturing process?* (U.S.A.)

This is really a job for a food chemist or engineer. In order to give detailed instructions it would be necessary for you to specify full particulars of your requirements and circumstances. This brief note is intended to give an indication of the procedure: Bring 20 gal. of water to boil. Add 224 lb. white sugar and boil. Cut off the steam and add 224 lb. of glucose and 224 lb. molasses. Take up to 160° F. Add water of 170° F. until gravity is 30° Bé. Maple sugar may be used in place of molasses.

Separation in Sauce

1,558. *We would be pleased if you could give us any information as to the cause of vinegar separation in sauce and a means of preventing it.* (Liverpool.)

It is difficult to give anything like a definite answer to your enquiry, as you do not give the ingredients you are using nor the method of preparing the sauce.

Speaking generally, separation is due to insufficient thickener or to the destruction of the thickener by hot vinegar. Commonly used thickeners are gum tragacanth, sago flour, wheat flour, cornflour, and arrowroot. The gum is soaked overnight in water and passed through a fine sieve. The cereal flours may be used direct or made into a paste with part of the vinegar. The mixture should be passed through a flat stone mill and fine sieve or through an emulsifying machine before bottling.

Tongue Loaf

1,559. *Could you give any indication of the method of preparing tongue loaf?* (London.)

Possibly the following may be of some interest to you. It is quoted from an American source and refers to pork tongue loaf.

A container having a heavy spring should be used for pork tongue loaf, as this product requires a much heavier spring than meat loaf. Tongues should be cured in regular S.P. ham pickle approximately 15 days. They are cooked in an open tank 1½ hours at 180° to 190°, then the bone, fat, gullet, and rough skin are removed.

Tongues are placed in the container crosswise, three layers high. Put the cover on the container and tighten the wing nuts thoroughly so there will be no leakage of water into the container. Then put the container in the cook tank and cook for 3½ hours at 170° inside temperature.

When the cooking period is over the product is removed from the cook tank and permitted to stand in normal room temperature for 1 hour. Cold water should not be run over the container. The advantage of letting the container stand in room temperature is to allow the juice to seep back into the meat product. Then place in the chill room for at least 12 hours.

Neither ground beef nor gelatin nor any other binder need be added. Whole pork or beef tongues cooked in this way in the right kind of container will bind into a solid loaf.

Drying of Fruits and Vegetables

1,560. *Have you any information regarding recent developments in drying fruits and vegetables in a powder form, retaining flavour and vitamins?* (Surrey.)

In answer to your enquiry about recent developments in the drying of vegetables, nothing seems to have been heard of any such developments which will enable material to retain its original flavour with absolute identity. If there is a new process and it involves rapid drying, it probably also involves drying under reduced pressure. The latest information to hand is on the drying of onions, but these do not involve drying under reduced pressure.

The other way of speeding up the rate of evaporation would, of course, be to reduce the material to a fine state of division and pass it through a drier, spread out on trays or a conveyor. If this is done in conjunction with reduced pressure, or, at any rate, under carefully controlled conditions of temperature and humidity, as well as air circulation, then it appears impossible to attain any greater rapidity of drying.

Whatever the conditions are as regards external factors under which drying is carried out, it cannot be seen how one can retain entirely the original flavour of the material.

One thing is certain, that in order to get the best results as regards flavour, drying would have to be carried out under as low a temperature as possible. The nearest analogy is, of course, to be found in the methods used in concentrating fruit juices by evaporation under reduced pressure.

It should be possible to develop a plant which would rapidly dry finely powdered raw material in solid form, and resulting in no appreciably greater loss of flavour than is experienced in the production of fruit juice concentrates. The latter is, of course, a much easier job, as the material is in a fluid condition, and one might reduce the differences to a minimum by taking note of the methods and plant used for drying powdered coal, which is so finely powdered that it can be handled much in the same way as a liquid.

RANCIDITY

To the Editor.

DEAR SIR,

I note that in giving instructions for extracting the fat (page 110, March, 1934) I directed it to be dried for a few minutes under high vacuum at "ordinary temperature." Actually, this should have read at "just above its melting point." At the time of writing I had in mind the liquid oil with which I have recently been using the method. If still practicable, this point might be corrected.

Yours faithfully,

COLIN H. LEA.

Pickled Beetroot

1,561. (1) *We have purchased a 40-gal. cask of piccalilli, but it is not sweet enough for our requirements. We are wondering if you could suggest any way of sweetening it without causing fermentation.*

(2) *Would you kindly let me know how to pickle beetroot for selling in half-gallon jars? These jars are, of course, not airtight and suffer a great deal of ill-usage*—i.e., *beetroot not properly covered with vinegar—with the result the beetroot goes mouldy before the customer has sold the quantity contained in the jars.* (Yorkshire.)

With regard to your enquiry of the 5th inst., beetroots should be pickled first in casks in a 6¾ per cent. solution of acetic acid for 48 hours before filling into jars, and then enough 16-grain pale malt vinegar is put in the jars to cover the beets well up. Under these conditions they will keep for some time.

A liquor for piccalilli may consist of:

16-grain malt vinegar	45 gal.
Mustard	36 lb.
Sugar	20 ,,
Gum tragacanth	6 ,,
Turmeric	7 ,,
Curry powder	7 ,,

The proportion of sugar to vinegar, you will see, is roughly about half. This is the proportion in most of the recipes for piccalilli.

Cheap Chutney

1,562. *I shall be grateful if you will supply me with a recipe for chutney costing not more than 10d. a gal.* (London.)

A recipe was supplied to the enquirer.

DOG BISCUITS

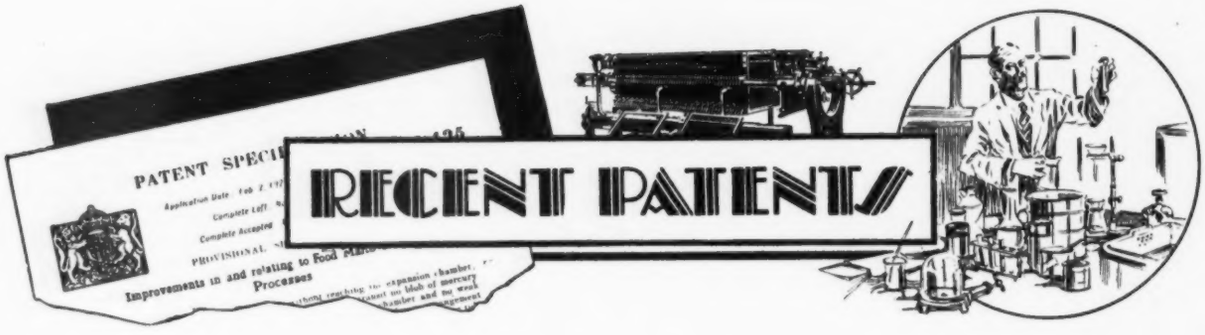
A Potential Market

THERE would seem to be an opening for the manufacture of better and cheaper dog biscuits and biscuit meals than at present on the market if a statement made in a lecture on the Continent be true—viz., that "dog biscuit is an expensive and worthless food."

Considering the large number of dogs that are fed on biscuit, that statement provides food for thought. It is recognised by dog owners that the diet should be a varied one and should include meat, cereals, and greenfood; the main food should, however, be meat. How does this apply to the majority of dog biscuits? The meat in them is dried and therefore concentrated, but the proportion of dried meat varies considerably with different makes; in none of them is it as high as it might be.

Dog owners appreciate biscuits and meals because they are convenient, but they would be better pleased if they knew that they contained an adequate quantity of meat. On to-day's cost of raw materials there would seem ample room for an increased proportion of meat and a reduction in price. Costs of production can be approximately gauged by analysis, allowing for any extras such as irradiation or added cod liver oil.

In making dog biscuits good sound flour should be used—white or wholemeal wheat or rye. Other ingredients are meat meal and bone phosphate, or meat and bone meal. Salt and flavouring may also be added. Jelly cuttings, horn and hoof meal should be avoided.—T. G. J.



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Latest Patent Applications

3469. Conservenfabrik Lenzburg vorm. Henkell and Roth, and Schlör, J.: Manufacture of fruit-juice beverages.
3470. Conservenfabrik Lenzburg vorm. Henkell and Roth, and Schlör, J.: Treatment of fruit juice.
3345 and 3346. Crosse and Blackwell, Ltd., and Johnson, R. J.: Sealing compositions for containers.
3632. Feagles, R. L.: Preventing deterioration of milk, cream, etc.
3547. Vogt Instant Freezers, Inc.: Packings for ice cream, etc.
4929. Fry and Sons, Ltd., J. S., and Millen, J. W.: Moulds for chocolate, etc.
4937. Nesfield, V.: Preservation of foodstuffs.
4412. Vogt Instant Freezers: Packaging ice cream, etc.
4666. Schou, H.: Preparing emulsions.
5732. Brendeke, W.: Devices for vacuumising and closing preserving, etc., receptacles. (Germany, January 13.)
5481. Feix, R.: Production of softened cheese.
5278. Illy, F.: Preserving roasted, etc., coffee.
5568. Norddeutsche Hefeindustrie Akt.-Ges.: Aerating fermentation liquids. (Germany, September 26, 1933.)
5099. Reichert, J. S.: Preparation of foodstuffs.
5316. Royal Baking Powder Co.: Method of preparing a food product. (U.S., February 18, 1933.)
5563. Sterling (London), Ltd., and Kernot, L. C.: Treatment of fish offal.
6097. Bawtree, A. E.: Means for colouring confectionery, etc.
6126. Long Co., W. E.: Cooling bakery products.

Complete Specifications Accepted

405,283. Yeasties Products, Inc.: Animal foods and methods for the preparation thereof.
405,354. Smith, F. S.: Electrically sterilising food products or the like.
405,374. Kremmling, A.: Apparatus for forming confectionery shapes by deposition of plastic or semi-plastic substances.
405,398. I.G. Farbenindustrie Akt.-Ges.: Refining of cotton-seed oil.
405,700. Ballard and Co., Ltd., F. J., and Davies, T. E.: Heat treatment of tins, bottles, and like containers containing fruits, vegetables, or any kind of food or preserved foods or the like.
405,875. Pollak, J. E. (Naamlooze Vennootschap Industrieele Maatschappij voorheen Noury and Van der Lande): Processes for clarifying molasses.

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, at the uniform price of 1s. each.

Published Abstracts

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, either sheet by sheet as issued on payment of a subscription of 5s. per group volume, or in bound volumes price 2s. each.

404,141. **Pasteurised Cheese Product.** E. Galbani. Convention date, Italy, January 9, 1932.

Pasteurised green-coloured cheese such as is obtained with the aid of pennicilium glaucum and any ordinary white cheese, also in the pasteurised condition, are admixed in the pasty form and then allowed to harden in the shaping moulds. The result is a product of marbled appearance for which excellent palatability is claimed.

Caffeine-free coffee. P. Gilbert. Convention date, France, February 15, 1933.

Coffee beans are first inflated by treatment with hydrogen peroxide, which also serves the purpose of decomposing the tannates of caffeine. The latter is thereupon eliminated by extraction with dichloromethane, which has the advantage of being a non-inflammable and highly volatile solvent (b.p. 40° C.). Attention is directed to the advantage of pre-treatment with hydrogen peroxide, which is tasteless and therefore cannot modify the characteristic coffee flavour. Nor does the process as a whole involve the risk of deterioration in flavour such as may be occasioned by the high-pressure treatment applied in other processes.

404,407. **Carton for invert sugar.** E. A. Barry and Manbrey and Garton, Ltd.

In place of the costly and inconvenient galvanised pails and wooden barrels formerly employed as containers for invert sugar and the like a specially designed cardboard or fibre container is now put forward. This is actually an improvement on the cardboard container specified in British Patent 377,330 of the same inventors. One of the essential features is a one-piece bottom in place of the usual four-flap type of bottom. The container (one-piece) is first positioned in a mould or partial mould of such a form as to produce a package and is then charged with a predetermined quantity of the invert sugar in liquid form.

404,459. **Yeast Manufacture.** H. Braasch and Dr. A. Braasch. Convention date, Germany, January 15th, 1932.

Intense aeration, which is now commonly practised during wort fermentation, involves the risk of destruction of the yeast, and this can be prevented, according to the present invention, by carrying out fermentation in an atmosphere containing not less than 0·5 per cent. carbon dioxide. This procedure also permits accurate regulation of fermentation, improves the colour, smell, and yield of yeast, whilst the relatively high proportion of carbon dioxide suppresses propagation of harmful bacteria, which otherwise multiply with great rapidity in the course of intensified aeration.